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The Philippine Agricultural Review

EDITOR

FREDERIC W. TAYLOR

Director of Agriculture

ASSISTANT EDITORS

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Assistant to the Director of Agriculture

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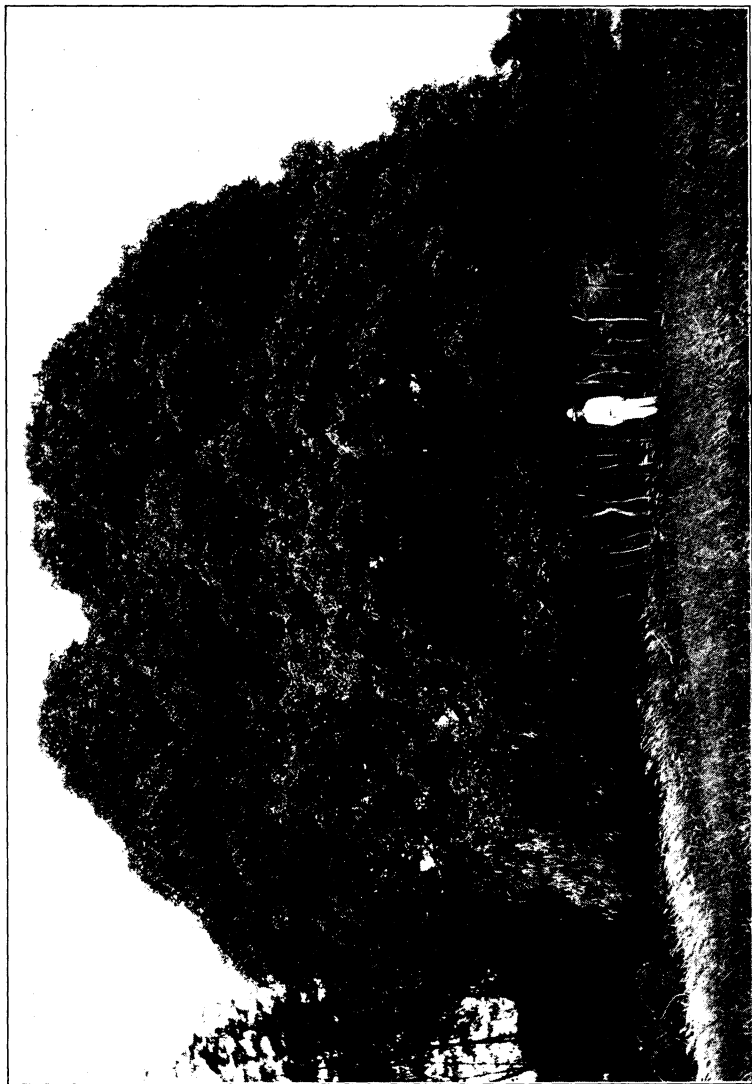


PLATE I.—A FULL-GROWN "PAHUTAN" MANGO TREE.

It has never been pruned. The lowest branches should be removed to make it a suitable avenue tree.

ORNAMENTAL HORTICULTURE

THE PHILIPPINE

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EDITORIAL.

By the DIRECTOR OF AGRICULTURE.

The public press of Manila has recently been writing a good deal about the beautification of the city through the planting of more trees, shrubs and flowers.

This is a subject very near the heart of the Bureau of Agriculture.

The Director, the horticulturist, and other members of the Bureau staff have given out interviews and endeavored to add their quota to the advancement of the idea.

This is a subject which applies with equal force to every city, town and hamlet in the Islands.

Nothing makes a town more livable than the added beauty which results from liberal planting and careful tending of those beautifiers, the trees and flowers.

In many countries there are local organizations known as "Improvement Societies" or by some similar names, the object of whose existence is to foster and encourage such work.

These societies usually go further and provide for the proper care of public parks, playgrounds, cemeteries, and other public or semipublic grounds. Uniform treatment of each street in the matter of variety of trees planted, distance apart and location with reference to street or lot lines is arranged for, and perhaps required by ordinance or order of the proper authorities.

Vacant lots are required to be kept in a sanitary condition and frequently cleared of grass or weeds.

The whole subject has a sanitary and economic value which would alone justify the spending of much effort and money in carrying it out.

Property in such a community is more valuable and desirable than in one where no attempt is made to bring about cleanliness and beauty.

The greater value, however, is perhaps in the educative effect, particularly on the young people. A young man or young woman brought up among such surroundings is not only a better citizen but capable of getting more enjoyment out of life.

There is an almost endless opportunity for such work as this in the Philippines.

One way in which it may be inaugurated is the following:

Some of the men and women in a community desiring to improve the local conditions get together, informally, and decide to start the movement. A public meeting is called to which are invited all those who have the same desire. An organization may be decided upon, or further time may be necessary to crystallize public sentiment.

Eventually, a society is formed, simple in its organization and arranged to get everybody at work.

It is then decided where to begin. Perhaps the streets are almost impassable during the rainy season and need first atten-

tion, or there may be vacant areas that are breeders of disease or mosquitoes. These matters are taken up and corrected first. Then may come the planning as to trees to be planted along the streets or in public parks, or it may be necessary to provide the parks themselves, if there are none.

In fact, the activities of such an organization may become almost numberless, as the work done commends itself to the people.

Very briefly this editorial is intended to open up some of the possibilities of self-help and local improvement, regarding which the Bureau of Agriculture desires to lend its coöperation and assistance in every possible way.

SHADE TREES FOR THE PHILIPPINES.

By P. J. WESTER, *Horticulturist*.

It is a trite saying that, natural advantages being equal, nothing is so influential in promoting the prosperity of the rural districts in a country as good roads. If this has been true in the past with its slow-moving vehicles it is doubly so now with the advent of better and swifter means of transportation, such as the automobile, the bicycle and the freight truck. Good roads link formerly isolated municipalities closer together, facilitate and reduce the cost of transportation of country produce to the cities, and open up areas of land for cultivation that heretofore have been more or less inaccessible. Altogether a good-roads movement tends to eliminate what is complained of as the "loneliness and dreariness of the country," and by facilitating the inter-communication between the farms and estates makes for more sociability and tends to render life in the country much more agreeable.

That the Filipinos are wide awake to the advantages to be derived from good roads is shown in the liberal appropriations for road construction by the Assembly from year to year, and the Bureau of Public Works is gradually extending its network of well constructed roads in the Islands, roads that put many century-old communities in the United States to shame.

The *construction* of the roads in the Philippines, as far as construction is concerned, seems to leave nothing to be desired, but there is still something lacking without which a road is incomplete and without which it does not serve its purpose to the utmost of its capacity—shade trees.

In Europe the desirability of lining the roads and streets with shade trees has long been recognized, as witness the continuous and magnificent avenues of trees along roads of unsurpassed excellence, stretching away through the country, particularly in the western part of the continent. In the United States there has been during the last few years an awakening in regard

to the same subject in connection with the good-roads movement, and avenues of young trees may now be seen growing up in numerous communities.

If avenues of shade trees are desirable along the roads in the Temperate Zone, they are almost indispensable in the Tropics. This position accepted, it merely remains to select trees that will best serve the purpose for which they are to be planted and such as are well adapted to the climate and soil in the region under consideration.

In selecting trees for street or road planting the following points should receive consideration:

1. The general adaptability of the tree to the soil, drainage conditions, precipitation and temperature.
2. Utility for shade.
3. Strength (ability to withstand damage by winds).
4. Immunity from insects.
5. Attractiveness.
6. Longevity.
7. Economic value.
8. Rapidity of growth.
9. Size (in relation to the width of streets).

Good soil with ample drainage will suit almost any tree within its climatological range, but where the soil is poor, sandy, or shallow, the drainage insufficient, or the rainfall limited, considerable care is required in the selection of shade trees in order to obtain the best results.

The general habit of trees varies widely in different species, rendering them more or less suitable for shade according to their growth, those having a moderately tall trunk with a spreading crown being preferable.

The construction of the root-system which enables the tree to get a more or less firm anchorage in the soil, and the relative toughness and brittleness of the wood and flexibility of the branches determine the ability of a tree to withstand devastations by typhoons. These two matters require particular consideration in a country like the Philippines, where terrific winds are of more or less common occurrence.

The control of insect parasites is a serious problem in the Tropics where these multiply far more rapidly than in the Temperate Zone, and trees that are subject to attacks from serious insect pests should therefore be avoided.

The rapidity of growth should be considered. Slow-growing trees are frequently ultimately more satisfactory than those of

quick growth, as the former have in most cases a finer grain, and thus are better able to resist the ravages of typhoons; however, they may not give the desired shade for several years. Quick-growing shade trees may then be planted between the slower-growing ones to provide shade in the interim, with a view to removing them as soon as the permanent trees are sufficiently large.

The ultimate size of the tree when it is fullgrown should be considered in its relation to the width of the street or road, and when the distance between the trees is decided upon, the general appearance and attractiveness of the tree, as well as its leaves and flowers, should not be forgotten in its selection for shade.

It should be remembered that shade trees are planted not only for those living to-day but to benefit coming generations.

The primary object is of course to provide shade, and usually the trees planted for this purpose have no other value. There is, however, no good reason why fruit-bearing trees should not be utilized as shade trees, and thus be made to serve two purposes, having always in mind that the primary object is to provide an all-season shade. In fact, the utilization of fruit trees as shade and avenue trees is in Germany employed on a very large scale, the different communities through which the roads pass auctioning off the fruit produced each season to the highest bidder. This system of utilizing fruit trees for shade on the public roads dates back for many years in Germany. In the small principality of Hanover alone, from 1876 to 1902 the amount realized from the sale of roadside fruit was ₱1,214,792, an average per year of ₱44,984. This system of turning the shade trees into a source of revenue has much to recommend it, and in this respect the Philippines might well emulate Germany, particularly as several of our fruit trees are admirably adapted to this double purpose.

The following species are recommended as avenue trees for streets and roads in the Philippines under ordinary conditions:

Albizzia lebbek Benth.

Cassia siamea Lam.

Diospyros discolor Wild. (Mabolo.)

Diospyros ebenaster Retz. (Zapote.)

Enterolobium saman Prain. (Raintree.) Guango.

Mangifera indica L. (Mango.)

Peltophorum inerme Naves.

Sesbania grandiflora Pers. (Caturay.)

Tamarindus indica L. (Tamarind.)

This may, to many who are familiar with the tree flora of the Tropics, appear to be a meager list. However, it has been limited to these species not only because of their suitability as shade trees but also because they are readily obtainable in the Philippines and do not require extraordinary care and precautions in their propagation. All are propagated from seed. Several other species have been recently introduced by the Bureau of Agriculture, which, it is hoped, will extend the list of suitable shade trees for the Philippines. These will be discussed in a future article in the REVIEW.

Four of the trees enumerated in this list are fruit trees, viz., the mango, tamarind, mabolo and zapote. Of these the mango is the shade tree *par excellence* for the Philippines from every point of view save that of rapidity of growth, which is, however, more than counterbalanced by its other admirable qualities, and which may be remedied by the planting of temporary quick-growing species in the interspaces until the mango trees give the desired amount of shade. The Philippine mango as a fruit of unsurpassed excellence has already won international fame and is our most popular desert fruit. This considered together with its majestic growth and its general utility as a shade tree and that the name mango itself is of malay origin, the mango might well be proposed as the national tree of the Philippines and as such be widely planted. In utilizing the mango as a shade tree it should be remembered that the different types vary in vigor and in order to obtain the best effect trees of a given type should be planted together and not here one tree of the Carabao, then a Pahutan and yonder a Pico. The Pahutan is the most vigorous of all and should be planted about 18 to 20 meters apart; the Carabao and the Pico are less vigorous, a distance of 15 to 18 meters being ample for either of these varieties.

The tamarind with its majestic build, slender flexible branches, and feathery graceful foliage, is a well known fruit tree unsurpassed for beauty that scarcely needs an introduction. The trees should be planted about 15 meters apart.

The mabolo and zapote are less robust and spreading than either species mentioned and require less room, a distance of about 12 to 14 meters between each tree being sufficient.

The guango or raintree is perhaps the most popular shade tree in the Philippines; in order to produce the best effects the trees should not be set closer than 18 to 20 meters apart.

Cassia siamea, one of our handsomest shade trees, suggest-

ing a quite refined, indolent elegance, as few shade trees do, is not appreciated according to its merits and should be more widely planted; about 12 to 14 meters apart is a suitable distance for this species.

About the same distance or a trifle more should be given *Peltophorum inerme* which vies with the preceding species in attractiveness, yet is different in habit and general appearance.

Albizzia lebbek should be planted about 13 to 15 meters apart.

Palms, beautiful as they are in their proper environment, are not well adapted to being used as road trees, as nearly all species have too little spread and give insufficient shade; the more robust ones like the coconut palm almost never develop a straight trunk and are therefore unsuitable. The utilization of palms for the ornamentation of the park and garden is discussed on another page of the REVIEW.

As already stated, the trees in the list embodied in this paper have been selected partly because of the ease with which they may be propagated. In fact their propagation is so simple that no municipality desiring to take advantage of the suggestions offered in this paper need hesitate to procure seed and establish a nursery in which to grow the young trees necessary. This might well be done by the school children of the municipality in the school-gardens that are now being instituted in most towns of the Archipelago by the Bureau of Education. This would also give the children and the coming generation a personal interest in the avenues that they could get in no other way. Wherever seeds of the species referred to in this paper are not obtainable locally the Bureau of Agriculture will endeavor to supply them upon request.

The nursery should be located as far as possible where the soil is loamy, fairly friable, well drained, and sheltered from the wind and, if possible, from the direct rays of the sun. Under an old tree is a good place. The land should first be spaded thoroughly to a depth of about 30 centimeters, all trash and rubbish raked off, and the surface leveled. Unless the land is quite well shaded it will be found advantageous to erect a small bamboo frame and cover it with cogon grass and under this prepare the seedbeds. The seed should be sown thinly, about 5 centimeters apart in rows about 12 centimeters apart, and covered lightly with soil. After sowing the seed, water the seedbed thoroughly, and again as soon as the surface shows signs of becoming dry. As soon as the plants are so large that they begin to crowd each other, say, 15 to 25 centimeters

tall, they should be transplanted to the nursery and set out about 30 to 40 centimeters apart, in rows about 1 meter or more apart. In all cases when plants are transplanted, about two-thirds of the foliage and the tender growth should be pruned off, as should also the taproot and other long straggling roots. Unless the work is performed during the rainy season, with the soil properly moist and the work accompanied by a good rain, the plants should be well watered before and after transplanting. The final transplanting, from the nursery to the avenue, should preferably be done early in the rainy season so that the trees are well established before the approach of dry weather. It is well to remember that small plants are more easily transplanted than large ones; plants 1 to 1.5 meters tall, pruned, are of a suitable size to transplant.

The space required by most trees when they reach their full development to display their full beauty to the best advantage is nearly always so great that as a rule several years' growth is required before they fully occupy the space allotted to them; in the meantime they provide insufficient shade and the avenue looks unfinished. This may be remedied by planting one or two quick-growing trees in each space between the permanent trees, and as soon as they begin to crowd each other the "auxiliaries," as it were, are removed. Trees well adapted to act as fillers are the raintree and the caturay; in fact, the latter species should never be used as a permanent shade tree.

Under all and any circumstances for the best scenic effects, a single species should always be planted in a continued file for a long stretch of road. The alternation of different species of trees in an avenue is an abomination, and is as incongruous and beauty destroying as would be different designs in the columns forming a colonnade; it is the continuity of design and its replication in tree after tree that in this phase of landscape architecture, as in that of the colonnade, produces the beautiful effects seen and admired in a well executed and properly cared for avenue.

In order to give the trees a good opportunity to establish themselves it is well to dig a hole for each tree 1 meter in diameter and about 30 centimeters deep, and in planting the trees to work soil in among the roots and fill the hole with surface soil instead of the subsoil dug out of the hole. It is also important that all trees of a given species be planted at an equal distance from each other and that they be set out in a straight line parallel with the road, or where the road is

curved that the line of trees be curved in conformity. After the trees are planted they should be well mulched and a tree-guard of bamboo about a meter in diameter put up around each tree for protection against animals and children. In order to promote the rapid development of the young tree it is well to keep a space of about a meter in diameter around each tree free from grass and weeds and keep the tree-guard in good repair for at least one year after planting for the more robust and quick-growing species, and for at least two years in the case of those of slower growth.

If the best results are to be obtained it is necessary to train the young trees, for "Just as the twig is bent the tree's inclined."

The training of a shade tree is neither as difficult nor does it require as much attention and pruning as some people would have us believe.

In Europe where everything is more or less stereotyped and formal, and space limited, it is the practice to frequently prune back the trees and thus create a compact and small crown. This may be done to some advantage with slow-growing plants and in the Temperate Zone where the development of the trees is naturally slower than in the Tropics. However, the practice followed in America, to permit the almost untrammelled development of the trees, the pruning being limited to the removal of the lower branches as the tree grows and the heading back of the more wayward growths, is in general more preferable in the Torrid Zone—where the growth of many plants is so rapid that it is readily recognized in a week—than the method of pruning pursued in Europe. The American method of pruning allows the trees to more fully develop and exhibit their natural beauty and to display to the fullest measure the individual attractive characteristics peculiar to each species. The European method is wholly unsuited to most tropical species, which are of rapid growth, and persisted in, soon leaves the tree an ugly, gnarled, dwarfed, mishapen skeleton, with a scant top instead of the majestic, straight-limbed and pleasing specimen that would result from judicious pruning.

The habit of some of the trees recommended as shade trees in this paper such as the mango, mabolo, zapote, and tamarind is naturally more or less compact and symmetrical and only in exceptional cases is it necessary to prune the trees except to remove the lower branches until a sufficiently tall trunk has been formed. In no instance should the distance from the ground to the lowest crotch be less than 3 meters and a trunk 4 meters tall is better. Others, like the deservedly popular raintree and

Albizzia lebbek, grow rapidly, branch irregularly from the very base of the tree, and frequently develop too heavy a top for the weak stem to sustain in an upright position; the young tree falls over, more shoots issue to correct the "irregularities" of the young trees, and if no aid is now given the inevitable result is portrayed on Plate II, *a*. Trees of this habit should be staked and tied when they are planted, using stakes at least 3 meters in height, and retaining them until the trunks of the young trees are sufficiently stout to stand upright without support, or replacing them with new ones if they rot before they have served their purpose. Bamboo stakes are perhaps better and cheaper for this purpose than any other. When the tree is 3 or 4 meters tall it should be allowed to branch for the formation of the crown and from now on this branching should be directed by the occasional heading back of obstreperous and awkwardly growing branches so as to form a symmetrical and natural skeleton frame-work of branches to support the "leafy roof." *In no instance should this pruning be allowed to degenerate into a general and indiscriminate slaughter of the crown branches every few weeks or months*, for this will result in another undesirable type of shade tree not unfrequently encountered. (See Plate III, *b*.)

Trees not unreasonably old, say, having a trunk not more than 10 centimeters in diameter, with ugly and unsightly crowns from the lack of pruning or from too much pruning, may be corrected by cutting off the trunk at the lowest irremediable bend from the ground. A number of sprouts will soon issue from the stump of which the strongest, growing out in a desirable position to make a straight trunk, should be tied to a long stout stake and as the new top is being formed, the surrounding sprouts should be gradually removed (not all at one time, however, for that is apt to seriously shock the tree and produce "frenching" or even kill it). In order to prevent fungi from entering the cut and to facilitate the rapid healing of the wound it is essential that only sharp tools be used in pruning. For the same reason a branch or limb should be severed as close to the trunk as possible and the wound painted with white lead, linseed oil or coal-tar.

Deciduous trees such as the firetree (*Delonix regia*), the mulberry (*Morus nigra*), dap-dap (*Erythrina indica*), and others that remain destitute of leaves, or nearly so, for weeks or months, should never be utilized as shade trees for that very reason, particularly as they are denuded during the hottest season of the year when shade is more than ever appreciated.

HERBACEOUS ORNAMENTALS FOR THE PHILIPPINE FLOWER GARDEN.

By P. J. WESTER, *Horticulturist*.

While a vegetable garden is of primary importance to the majority of people, its ornamentation by the cultivation of a few ornamental annuals adds so much to the attractiveness of the home that no one who has a few square meters of ground should omit the planting of at least a few varieties. If wisely selected, their beauty and the pleasure they give amply recompense the grower for the care and attention bestowed upon them. In the Temperate Zone the annuals that will thrive and that may be selected from the seed catalogue are well-nigh legion; but in the Tropics, contrary to the expectation of many who come here, the reverse is the case, due frequently to the fact that so many of the flowers cultivated in the United States and Europe are indigenous to, or have been cultivated for many generations in a climate very much different from that of the Tropics. The following is a list of annual and perennial flowering herbaceous plants that have been found to succeed in the Tropics, whose propagation is not difficult, and which may be used in the making of flower-beds and borders, or for cut flowers, with the expectation that they will do well, provided that they receive the proper care.

<i>Amaranthus</i> spp.	<i>Heliotropium</i> (Heliotrope).
<i>Angelonia grandiflora</i> .	<i>Hibiscus sabdariffa</i> (Roselle).
<i>Anthirrhinum</i> (Snapdragon).	<i>Iberis</i> (Candytuft).
<i>Calliopsis</i> .	<i>Impatiens balsamina</i> (Balsam).
<i>Canna</i> .	<i>Mirabilis jalapa</i> .
<i>Celosia</i> (Cockscomb).	<i>Nasturtium</i> .
<i>Chrysanthemum</i> (Annual).	<i>Petunia</i> .
<i>Coleus</i> .	<i>Phlox Drumondii</i> .
<i>Coreopsis</i> .	<i>Salvia splendens</i> .
<i>Cosmos</i> .	<i>Scabiosa</i> .
<i>Dahlia</i> .	<i>Tagetes</i> (French Marigold).
<i>Gaillardia</i> .	<i>Verbena</i> .
<i>Gomphrena</i> (Globe Amaranth).	<i>Vinca</i> (Periwinkle).
<i>Helianthus</i> (Sunflower).	<i>Zinnia</i> .
<i>Helichrysum</i> (Everlasting).	

Excepting the Nasturtium and the Iberis, the seed of which should be sown direct in the flower-bed, these plants are all propagated from seed, which should be sown in a well protected seed-bed or shallow box, transplanted, and set out in the flower-bed as soon as they are sufficiently large for the purpose. (For detailed directions see Bureau of Agriculture Circular No. 9.)

Some of the plants are perennial and may be propagated by the division of the plants, such as the Angelonia, Canna, and Gaillardia. The Angelonia, Coleus, Heliotrope, Salvia and Verbena are also easily propagated from cuttings, and any desirable

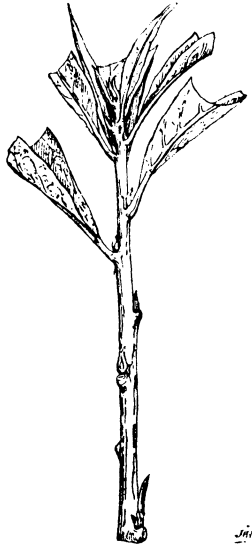


FIG. 1.—Cutting prepared for insertion in the soil.

seedlings of these species that may be discovered near the original plants may thus be readily perpetuated. Fresh-water sand is the most suitable medium for the rooting of cuttings; lacking this a light sandy loam may be used. Put the sand in a box about 10 centimeters deep, the box being placed in a well sheltered shady place. The cuttings should be made about 5 to 7 centimeters long, about two-thirds of the leaves trimmed off, and the cuttings inserted in the sand about one-half, or a little more, of their length, and then well watered and shaded; as soon as they have rooted, transplant into a shaded plat with good garden soil, and, when they are sufficiently strong, transplant to the flower-bed.

ORNAMENTAL AROIDS.

By O. W. BARRETT, *Chief, Division of Horticulture.*

The Family Araceæ is one of the queerest groups in all the plant world. There is frequently some difficulty in determining off-hand to which family a certain ornamental belongs; an aroid, however, is so strikingly different in nearly all cases that even an amateur can "pigeon-hole" a specimen at sight. Though of vastly different habits as regards foliage, flowers, stems, and soil (or water) preferences among themselves, they have a kind of substantial luxuriance, a lush, rank way of carrying their beautiful glossy leaves, that always makes them striking objects whether in jungle or conservatory, potted or set in the lawn border.

This family, too, can boast of holding some of the very oldest cultivated plants—the taros and yautias—and the *only* ones that *never* produce seeds. Yet, with all their prominent features and great antiquity, the group as a whole has been shunned by botanical collectors, largely for the reason that they could not make good "herbarium specimens" from them—could not dry the juicy tissues before decay would begin. Ask the average botanist to show you a mounted specimen of a taro (gabi) flower, for instance—and count his excuses.

As foliage plants the aroids can scarcely be equalled by any other group. If you would test to exhaustion your color sense and appreciation of complex patterns in leaf ornamentation just walk through a Caladium propagating establishment where, say, one thousand varieties are vying with each other for the ideality degree.

The metallic shades and iridescence of some Alôcasias can not be excelled in the Vegetable Kingdom. For striking outline of leaf can anything equal the Anthuriums or our Epipremnums (Tibátib), and does any but an aroid dare to display a perfectly fresh leaf full of holes and slits, like the Monstera?

On the other hand, no great popularity will ever accrue to

the aroids through their flowers. To be sure, the old Calla, or as we should now call it, the *Richardia*, and its yellow, spotted, red, and black cousins are famous; and some of the world's largest (but not sweetest) flowers are of this family—as witness the “Stanley's Washtub,” and our common Apon (*Morphophallus*) with its one-kilo boutonnière.

For the amateur horticulturist one excellent character of the aroids is their facility of propagation: few need to be raised from seeds; most grow readily from root or stem cuttings, while others produce bulb-like offsets and corms which can be “held over” dry or “started” at will. Of the latter type, the Caladiums are worthy of very much more attention than they receive here in the Philippines; the few old-fashioned sorts now in evidence in our yards and parks will, let us hope, soon be replaced by the brilliant but daintily colored varieties so common in other countries; even those unfortunates who have little liking for plants cannot fail to stop and examine a good specimen to see whether the crimson spots and splashes are real blood and whether its transparent areas are genuine holes.

The magnificent Colocasias, Alocasias, and Xanthosomas grow readily from root sections and offsets; and these plants always give an air of sumptuous dignity to rockery-pile, a center-bed or even a fence-corner. Varieties can be had from $\frac{1}{2}$ to 2 meters in height; some may seem, to the passer-by, to be merely a glorified gabe, or taro, but the magnificent green, or variegated, purple-stemmed, or marbled-stalked Yautias and Alocasias are in a class by themselves, and a *high* one. They may be massed in beds or placed singly among the shrubbery and lesser herbs.

As climbers the aroids are without equals for a tropical effect. The rank-growing Epipremnums with their aerial roots and ragged-edged leaves are fairly common here already; likewise the odd old Pothos with its gold-blotched foliage—no two leaves ever of the same pattern—is coming into favor. However, there are plenty of other good scandent species. We also hope to see the wonderful *Monstera deliciosa* with its fragrant edible fruit and button-holed leaves a general favorite.

In shaded corners and around very wet areas most ornamentals refuse to even exist; but that is where many of the aroids literally shine. The curiously variegated Dumb-canes, or Dieffenbachias, or some of the Arisæmas, Arums, and Anthuriums revel in plenty of water and shade and are all worth the attention of one who likes to have something a little better than the next-door neighbor's.

ORCHIDS: THEIR CULTURE IN THE TROPICS.

By P. J. WESTER, *Horticulturist*.

Orchids more than any other class of plants have exercised a fascinating influence upon man ever since they were brought under cultivation; the discovery of many reads like a romance; for the adornment of some conservatory and to satisfy the whim of some wealthy collector, more money has been spent and more lives have undoubtedly been lost in collecting them than is the case with any other distinct group of plants. They were among the first plants to be hybridized, and the orchid hybrids are now well-nigh innumerable; it is safe to say that the pedigrees of the orchid hybrids are more accurate and longer than those of any others.

Orchids may be divided into two classes, terrestrial and epiphytes, according to whether they grow in the earth or attach themselves to the tops of other plants—usually the trunks and branches of trees; the gardener and horticulturist in America and Europe separate them into three classes, “hothouse” or “East Indian orchids,” those of the “temperate house,” and the “cool-house” orchids, depending upon the altitude and latitude of the place of origin. The term “temperate” is, in this case, rather misleading, for the orchids grown in such a house do not come from the Temperate Zone but from tropical countries with a pronounced wet and dry season. In fact most orchids are found within the Torrid Zone, though some occur at altitudes where snow falls and where the temperature is low even in summer.

Orchids are still such rarities to most people living in the Temperate Zone, and their proper culture there so comparatively recently understood, that most people regard the orchid as a very mysterious plant, whose culture must also be correspondingly mysterious and difficult. As a matter of fact, neither is true, and in the case of the orchid as with any other plant, in order to be successful in its culture, it is merely necessary to



(a) Guango, about 12 years old, the result of no training. (Note the young untrained trees of the same species in the background.)



(b) *Peltophorum inerme*, a young tree topped too frequently. It will never become a perfect specimen.



(c) A fairly good specimen of the Guango. If the crown had been pruned less from below, the tree would be better proportioned.

PLATE II.—SHADE TREES.



(a) Royal Poinciana, about 9 years old; note the knotty ungraceful limbs, the result of too frequent and indiscriminate pruning.



(b) A young Guango, the result of overpruning; full-grown, it will never have the straight tree trunk and the shapely limbs that distinguish a well-trained tree.



(c) Royal Poinciana, the result of too close planting and injudicious training.

PLATE III.—SHADE TREES.



PLATE IV.—A WIDELY DISTRIBUTED PHILIPPINE ORCHID.

study the climatic conditions under which a particular species grew and to simulate them, and improve upon them, if we can.

Living in a tropical climate we cannot here grow "cool-house" orchids, nor indeed is there any need for lament therefor with the abundance of the tropical material to choose from. In fact, most attractive native orchids can be obtained at a slight cost by any one interested in them. Several species of orchids greatly esteemed in America and Europe grow wild in the Philippines; for instance, several species of *Dendrobium* and *Phalaenopsis*.

There are a number of terrestrial orchids that may be grown in the garden like herbaceous annuals, provided, however, that the drainage is very good. In order to obtain the best results the soil should be largely humus and sand with very little clay and the plants grown in a semishaded position.

Most orchids are epiphytes, however, and because they grow on trees with no visible nourishment, many "orchid fanciers" in the Philippines tack them to a piece of wood and think that an occasional dash of water by the muchacho is all they require. As a matter of fact, the plants, due to their wonderful vitality, live and frequently produce good flowers in spite of this neglect and the owner congratulates himself upon being an orchid grower. This self-satisfaction is based, however, upon the fact that he has perhaps never seen a well-grown specimen, and it is safe to say that with proper culture the quantity of flowers produced would be from one and one-half to two times that obtained with the average care orchids now receive in the Philippines.

As has already been stated, the epiphytic orchids seem to flourish in their native habitats without any visible sustenance. However, they receive more or less from the vegetable matter that collects in the crevices of the bark of the trees where they support themselves and in some cases they send out a stiff "brush" of roots at the approach of the rainy season, pointed upwards and outwards to catch falling leaves, etc., and thus they supply themselves with the best conceivable plant food, and are really far more terrestrial in their habit than a superficial study of them would indicate. In this lies a hint for the would-be orchid grower that few appreciate. As is well known the tropical rains carry a considerable amount of nitrogen which also benefits the plants.

While our orchids delight in a drenching tropical shower, perfect drainage is none the less essential, both during the rainy and growing season as well as during the dry and flower-

ing season, and whatever receptacle is used in which to suspend the plant, it should be constructed so that no water collects and sours the medium in which the plant is to grow. Coconut husks held together by galvanized or copper wire make unique and attractive receptacles for orchids, or baskets may be made of hard, slow-decaying wood. To be attractive and to serve its purpose well an orchid basket should be just large enough to hold the plant without crowding it; if a large specimen is desired, several plants may be put in one basket. About half or more of the basket should be filled with broken pots and charcoal and the plant then "basketted"—that is, planted in the basket. In doing this, place the plant in position in the basket and work in among the roots equal parts of leaf mold and decaying leaves, and bits of charcoal and broken potsherds. Do not set the plant so deep that the buds from which the new growth, or pseudobulb as it is called technically, springs, are *under*, but rather just about *even* with the soil surface. In order to hold the plant until it has taken root wind wire over and around the basket. This work should be done a little before the advent of the rainy season just as the plants are starting into growth, and the plants should be watered sparingly until they come into active growth. If they are not exposed to the summer rains they should be watered regularly and never allowed to become so dry that the growth is arrested. It is also beneficial to feed the plant by watering it with or dipping the basket in cow manure water of about the color of weak coffee every two to three weeks. Lacking manure water, a chemical fertilizer answers very well. The writer has found that the following formula produces excellent results applied at intervals as stated above:

Nitrate of soda	grams....	27
Sulphate of potash 49 per cent.....	do.....	12
Acid phosphate 16 per cent.....	do.....	30
Water	liters....	10

The fertilizer should be well dissolved, and the solution stirred from time to time in order to prevent the acid phosphate from settling to the bottom. It is probable that low-grade sulphate of potash or muriate of potash can be used in lieu of the high-grade. Twenty-five grams of either of these fertilizers should then be dissolved in 10 liters of water. If superphosphate is used instead of acid phosphate about 10 grams will suffice.

By this artificial forcing the writer has obtained in one season

two growths instead of one and has doubled the amount of bloom produced.

Any man who is at all interested in his plants will notice when the pseudobulb has attained its full growth. It then swells out and "fattens up," to use the term of the professional grower. The leaves also begin to lose their freshness. If this is well toward the dry season, water should be gradually withheld until the plant is left almost dust dry. The leaves of the deciduous species, such as the *Dendrobium superbum*, so frequently seen in Manila, now fall and later the flower buds appear. Then and during this period of ripening of the pseudobulbs and the season of flowering, supply water sparingly, or barely enough to prevent the pseudobulbs from shriveling too much and the flowers from wilting and the reward will be a fine spray of bloom lasting in some species several weeks before they fade, after which the cycle in the life of the plant is past. If it can be avoided, the pseudostems of a plant, as long as they are in good health, should never be removed for this is a drain upon the vitality of the plant.

Many orchids like the *Cattleya* and *Laelia* and *Oncidium* are not deciduous. However, their treatment is essentially the same as described above; with some of these species it is necessary to withhold water until the entire plant is quite shriveled up before it yields flowers. Likewise certain species of *Dendrobium* may produce fine pseudostems for year after year but fail to bloom until they are properly dried up. On the other hand, certain orchids devoid of pseudobulbs, or stems, such as the genus *Phalaenopsis* and *Cymbidium*, should receive a moderate amount of water throughout the year.

With reference to light it may be stated that the more light and sunshine the plant receives without excessive exposure to the sun, the more flowers will it produce; particularly is this true during the dry season, and during the resting season of the plants before they come into bloom. In this as in other respects the orchid grower can not do better than to study the individual species in their native habitat and environment.

No plants are more fascinating, more royal, coming more direct from the Creator as it were, than many of the orchids; therefore, here in the native home of many of them, where they can be obtained at a mere nominal figure, and where everything is conducive to their luxuriant development, let us have more of them, fill our houses and gardens with them, and enjoy in the fullest measure their beauty and fragrance.

TREES FOR STREET PLANTING AND FOR ORNAMENT.

By WM. S. LYON.

For highly creditable achievements in both street-tree planting and in ornamental-tree planting, unstinted praise is due to the municipal government of Manila in general, and in particular to its chief tree-planting executive, Mr. J. C. Mehan.

A goodly share of credit is also the meed of those provincial authorities who, with slender resources, have done much to beautify the surroundings of and approaches to their public buildings.

Per contra; too much obloquy and opprobrium cannot be heaped upon the heads of nearly all the foreign residents of the Philippines (citizens of the United States especially included), of whom it is quite safe to assert that 95 per cent have never contributed a single dollar in time or money toward tree planting for the common good, or to *any* planting outside of that prompted by a selfish interest in the plot of land which they perhaps occupy.

Street-tree planting is properly a municipal function and the haphazard planting of the same by untrained enthusiasts is to be discouraged; but this neither extenuates nor excuses the disgrace of permitting vacant urban or suburban lots to become a waste and wilderness of noxious weeds, eyesores, and a public nuisance, when an insignificant outlay would convert them into attractive groves, a credit to the owner, a boon to the present and oncoming generations, and a more lasting monument to the civic pride of the owner than one of stone—especially if it be of so-called “Guadalupe.”

A pungent remedial measure applied by boards of assessment would be more effective than miles of written protest and petition.

A trivial reduction in assessment upon well-groomed vacant lots and a corresponding increase in assessment upon the run-to-seed lot, would quickly bring about an improvement in this respect on the part of those who shoot only at the “unearned increment.”

The story of how such betterments can be made *profitable* to the owner is for another time.

It should be remembered that every village or tiny barrio is a potential metropolis and that the quagmire carabao trail of to-day may give way to the trolley and the macadam avenue tomorrow. If the wrong trees are planted, and at the wrong distances, or without alignment, lasting mischief has been wrought. Easy to chop them down? In theory, yes; in practice, almost impossible. The cry of "vandal" echoes through the land and a symposium of the "Woodman-spare-that-tree" guild are in arms for the official scalp of the tree executioner.

Sentiment must be reckoned with and properly so. Ninety per cent of all folks who give or care a rap about trees have their favorites; but most times their sentiment comes in conflict with the stringent, almost cast-iron, limitations of appropriate plantations.

As a telling example, where an exuberance of gush was not safeguarded with a knowledge of all the facts in the case, may be cited the red-headed mania of enthusiasm for the street planting of the gorgeous fire tree, or caballero. This found expression in the unfortunate planting of too many of these upon the streets of Manila. Even one tree (for this purpose) would have been one too many. There is nothing of quite such spectacular beauty in the whole plant world, nothing much better suited for parking, and nothing quite so ill adapted to street planting.

Either of its salient and serious defects condemns its utility for this object: One, it buttresses strongly with increasing age and, in time, will rip up the most substantial curbing or paving; the other, it is a deciduous species. Its deciduous habit would be a positive gain were it in gear with our seasons. Unfortunately, however, it becomes wholly defoliated during March, April, and May, our season of maximum heat and sunshine and when we most require street shade. On the other hand, in mid rainy season it supplies the densest shade when we least need it.

For wide streets and avenues, experience has shown that we have nothing better than the raintree, or acacia, as miscalled, and its excellence for this purpose is confirmed by its extended use in many large, oriental, tropical cities.

Here in Manila, from the time of the Spaniards, the mistake of too close planting has been made and, unfortunately, the mistake has been perpetuated in more recent plantings. True, under the excellent systems of typhoon protection afforded them

by frequent toppings this defect of too close planting is not at present observable, but many that are now touching heads will soon be beyond the reach of effective top pruning when they perforce, by crowding, must begin to spindle. There is no single tree in Manila that has had freedom for its perfect development, and of the thousands who pass under our trees daily, it is doubtful if more than a score have ever seen this noble tree at its best, or have an adequate conception of its surpassing beauty when untrammelled.

Thirty meters apart, on streets 40 meters wide, is the minimum at which it should ever be planted and, to afford more crown space, it should be set diagonally at that. There are physical objections, patent to any competent road builder or engineer, which should prohibit their use on streets or avenues less than 30 meters from curb to curb. However grateful the shade to the passer-by, complete and continuous shade is not grateful to the crown of any street paving material known, unless it be perhaps solid stone blocks. The greatest spring, and consequently the quickest escape of surface water from a well-built road is nearest the curb. Here too, it is protected with a paved or cement gutter, hence not so subject to injury from the dense shade of the aligning trees.

For streets of medium width (18 to 20 meters), our so-called yellow cassia (*Peltophorum*) is *facile princeps*. Its one trifling defect (yielding considerable trash) is lost sight of in its many excellencies. For early appreciation of its utility, an appreciation which has found expression in enormous plantings *en bloc*, and without the unpardonable crime of making tree sandwiches, by interspersing other kinds, has left the coming generation deeply beholden to Mr. Mehan. Rizal Avenue is more than redeemed from the stigma of being merely an aggregation of straw shacks and should command international repute as a royal highway. The recent change of its name from Cervantes to Rizal instead of to Mehan, indicates that the present generation did not appreciate its opportunity to render a fitting tribute.

Tree sandwiches are only admissible where some slow-growing, permanent, and valuable species is wanted, and withal, temporary protection from sun, wind, and dust is desired. Such an illustration is afforded by the new streets of the "Luneta fill," where the extent of the salt deposits admits of question of the durability of the desiderata.

Here, it would be legitimate to interspace them thickly with

"aguja" and Katuday and in two or three seasons at most the economic ends sought are attained.

If the kinds planted "on suspicion" thrive, the others can be exterminated—at night—while the "Woodman-spare-that-tree" clique sleep.

For very narrow streets, or wide alleys, the Palo Maria, the white flowered (Chinese) champaka and the Chinese litchi are three of the best. The former, in loose sandy soils, often becomes a large tree. Where exposed to the dense compacting effect of street and sidewalk making, it rarely attains a height of more than 12 meters. Both it and the champaka form and retain symmetrical crowns with the occasional use of the shears.

To name the litchi (the best of the lot) is to depart from a precedent which forbids the use of any fruit tree upon a public street.

Throughout the continent of Europe there are miles of public highways planted to fruit-bearing trees and this inhibition applies only to the Philippines. It is not to dispute the right of the cedula payer to participate in the fruits of his taxes, but because of his total disqualifications as a fruit harvester. His "get 'em anyhow" methods of fruit gathering are not conducive to the health, beauty, or durability of the tree.

The *seedling litchi* has proven to be unproductive of fruit in Manila to a known age of twenty-six years and is presumably immune from the fruitpickers' depredations.

There is only one avenue (Taft) of magnificent proportions left unplanted in Manila, and in the face of precedent, and of some basic objections, the sacrifice of principle might be justified for the sake of enjoying the unique distinction of having the only great "mango" driveway in the world.

The radical objection is, that some mango trees have a poor root system and topple over. For park planting this is no deterrent, for they continue to cheerfully grow and become more umbrageous than ever.

While this condition could not be tolerated upon a public thoroughfare, the presumption is very strong that the system of close topping now observed in this city, and carried on until no longer practicable, would result in a root development and a stem stocky enough to resist any ordinary typhoon.

Through a most regrettable mistake in the removal of the central line of giant bamboos which once adorned Calles Iris and Azcarraga, we lost our prestige as having the only bamboo-planted avenue in existence. A mere bamboo hedge, such as

aligns half the village streets in the Tropics, is in no wise distinctive. These were in isolated clumps and created a unique, scenic splendor the loss of which is to be deplored. The reduction of the street grade left them stranded upon unsightly hummocks, which should have been remedied with a coping filled in with soil. The extraordinary width of the street would have justified their retention and admitted of the excellent sidewalk planting now in evidence. The only things to compete with this giant grass in scenic effect are palms—an avenue of royal palms contributed as much to make Hawaii known as beer did Milwaukee. Now the day has passed, for they have palm drives on the Riviera and a "Palm Avenue" is a feature of every mushroom village on the Pacific Coast of the United States south of Point Conception.

Among trees planted for sidewalk purposes more or less frequently in Manila, and in very many other towns in the Archipelago, we find the dalisay, or wild almond; the ilang-ilang; the sampalok, or tamarind; the coral tree (*Erythrina*); and various fig species. Recommendations to plant any should be prefaced with "don't's."

The tropical almond, wherever observed, except in Cebu, is the victim of a shot-hole borer which makes its leaves unsightly at all times. The ilang-ilang becomes scrawny and unkempt in time and furnishes insufficient shade. The sampalok, except in very deep alluvial soils, buttresses heavily. The erythrinæ, glorious as they are in flower, are subject to rapid decay and, like the fire tree, are leafless in the hot season; and the best varieties of figs are indisposed to thrive if restricted to the normal number of boles allotted to most street trees.

The general ban put upon fruit trees for street planting eliminates the catmon, the santol, and the mabolo. Medium-sized up to large trees of great beauty and hardiness are occasionally seen upon the lines of village streets, but in most cases they have probably been planted within the original abutting property lines for their fruiting qualities only.

Among the most emphatic of all the "don't's" should be included palms of all kinds. Few if any are exempt from insect depredations—depredations which can only be combated at serious cost and untiring vigilance. At best, they furnish inadequate shade, and when young they impinge upon the rights of pedestrians to the sidewalk. Their tenure of life hangs upon the

slender thread of one terminal bud. If this is cut or broken by a falling electric wire, death inevitably supervenes.

The planting of *any* street tree in the Tropics is opposed by the advocates of the "sun bath" and by some people as harboring mosquitos. With any amount of tree plantings, a few stray but ardent sunbeams will for all time be available. Trees may and do harbor mosquitos, but do not breed them. Eliminate their breeding places and there will be none left for the trees to harbor.

SUGGESTIONS IN TROPICAL LANDSCAPE ARCHITECTURE.

By P. J. WESTER, *Horticulturist*.

The Tropics more than any other part of the world is the paradise of the naturalist and plant lover. Nowhere else do we see such exuberant growth and such lavishness of foliage and flowers except in the conservatories in the Temperate Zone, and there the marvelous effects attained under good management are created by the aid of Flora's tropical children transported from their far native homes. Some traveler and naturalist has remarked upon the poverty of floral displays in the Tropics in contrast to the wealth of flowers that adorn the meadows of England. If he referred to the herbaceous flora of the two zones, the Temperate and the Torrid, we may concede the truth of this statement. However, this is a one-sided comparison. The flora in its entirety should be considered; and who will then deny the blue ribbon to the Tropics? Where in the Temperate Zone does one see such magnificent floral displays as a group of flamboyants, *Colvillea*, Banabá, the Barbados "flower fence," the oleander, or *Spathodea campanulata*? Many of the water lilies are of tropical origin, including the most famous of all, the *Victoria regia*. A field—or shall we say a lake—of water-hyacinths in bloom is not likely to be soon forgotten; what temperate aquatic can compete with the royal lotus? and again, are not the Tropics the home of the most gorgeous of those blue bloods of the vegetable kingdom, the *Cattleya*, the *Laelia*, the *Dendrobium*, the *Vanda*, the *Phalænopsis*? As if she were not satisfied with having scattered with the utmost lavishness brilliant flowers in the Tropics over the two kingdoms of the earth, land and sea, nature has further endowed the leaves of many of her children among the cryptograms with the iridescent colors of the rainbow, not to speak of the opulent wealth of color in some of the herbaceous shrubs, such as the *Codæums*, certain pandans, and *Heliconias*. Nowhere as in the

Tropics does nature display such protean wealth, from the lofty palms, unsurpassed in stateliness, the willowy bamboo, and the majestic forest trees, to the shrubs and herbaceæ, with an opulence of foliage to satisfy the most exacting, and to the humble ferns yet unsurpassed in grace and loveliness—not to forget the tree ferns, many of which are the *ne plus ultra* of all that is at once stately and graceful, nor the innumerable climbers that are perpetual sources of delight to the plant lover because of their habit, flowers, and foliage.

With all this vegetative wealth at home in usually rich soil, with abundant rainfall and ample natural heat, what remains is merely the tasteful arrangement thereof by the horticulturist and landscape architect, and the subsequent care in order to obtain and maintain the best effects.

In the ornamentation of parks, squares, streets, and avenues of a city, or in the laying out of an estate or a small city lot, utility and appropriateness of every object created should always be obvious; there should always be a reason for a walk here, an open vista there, or a group of shrubbery yonder. It should be remembered that an object that serves no purpose is out of place and that the saying or in words to that effect, that that woman is best dressed of whose apparel one can recollect no detail, applies in no inconsiderable measure to an ornamental ground. If all is harmoniously and tastefully arranged, no single feature should glare us conspicuously in the face, and the whole should give an impression of completeness that would be disarranged by the removal of any one part.

The first requisite for an attractive park or garden, be it large or small, is a good lawn. The lawn is for the park what the background is for a beautiful picture. A good, ornamental garden without a good lawn is as inconceivable as a picture without a background.

Next comes the laying out of the road and paths. In this the width of the road should be considered in connection with its purpose, the greater the traffic the wider the road. A winding road is more attractive and pleasing as a rule than the straight line; but care should be exercised in its design, or it may border on the ridiculous and grotesque.

In the planting of trees due discrimination should be made in order to attain a certain object. Shade should ever be the watchword when trees are selected for the street and avenue in the Tropics, while there are also other points to be taken into consideration. (For a full discussion on this subject see "Shade

trees for the Philippines" in this issue.) There are many exceedingly attractive trees that must be discarded as shade trees and relegated to the park alone because they are deciduous during the dry season when shade is most needed. In the park the selection and grouping together of trees should depend upon their ability to supplement and enhance the beauty of each other whether in habit, flower, or foliage.

Do not crowd too many plants together in a small area. In an effort to have a "little of everything," sight is frequently lost of the appearance of the whole, with the result that the garden becomes a "curiosity shop" as it were, instead of a garden. Not only is it necessary for a tree or plant to have a certain space if it is to attain its proper and material development, but additional space is required to "set off" the object, or in other words, a background. Frequently the best effect is obtained by a solitary specimen tree on the lawn, but if the grounds are ample, a group of trees may be planted to advantage. The ultimate size of a tree or plant should always be considered at the time of planting, remembering that too close planting is not conducive to the attainment of the best effects.

Palms! This single word instantly conjures up visions of the Tropics. As a matter of fact, this distinct family of plants seems to be more used for decorative purposes in the Temperate Zone than in their native homes. Many millions of palms are annually propagated in greenhouses in the Temperate Zone for decoration purposes and used to adorn the houses the year around and the garden and park during the summer. It is safe to say that they are more in demand for this purpose than any other group of plants.

According to their habit and behavior the palms may be used in a variety of ways for decorative purposes. Because of their slow growth and comparatively small spread of crown which gives but little shade, they are not as frequently planted for street trees as they deserve from a purely ornamental point of view. This is a matter for much regret because no shade tree can approach a well developed palm of certain species in clean-cut knightly beauty. A tree may be the most majestic or the most graceful, but the palm is, nevertheless, distinctly in a class by itself. "The princes of the vegetable kingdom," so were the palms termed by the great Linnæus, and there seems to be no reason for a revision of that expression. And yet Linnæus received his impressions of the palms from descriptions by others, from herbarium specimens, and from what must have been but

poor specimens found in the crudely-constructed greenhouses of his day. We can but conjecture his expressions if he had seen the palms in their native habitat. One cannot but regret that the great plant lover and botanist never saw the real Tropics—but to return to our subject. If palms are unsuited to line the wider streets and thoroughfares of a city or the country, they should be planted along paths and walks in the park and plazas whenever this can be done so as to conform to the general design.

For avenue purposes only, species having a straight trunk and a fairly well developed crown should be chosen, such as the Canary Island date (*Phoenix canariensis*), the royal palm (*Roystonea regia*), the California fan palm (*Washingtonia robusta*), *Cocos plumosa*, Buri, *Corypha elata*, etc.; the date (*Phoenix dactylifera*) makes a very satisfactory avenue tree, though it has a rather "stiff" and ungraceful appearance; for narrow walks and the "patio" the "Boñga de China" (*Normanbya merrilli*) is excellent. As an all-around avenue tree perhaps no species surpasses the Canary Island date. The royal palm is indeed excellent when from 5 to 10 meters tall, but it unfortunately grows so rapidly as to lose its greatest charm while it is still comparatively young. For the best effect palms should never be planted so close in the avenue that the leaves interlace. For massing, as solitary specimens on the lawn, or in the shrubbery, all palms may be utilized more or less. For a "grove," particularly near water, none is more appropriate than the coconut palm. In planting a "grove" for ornamental purposes be sure not to plant an "orchard," or else much of the charm will be lost.

The bamboos are of unique beauty, with their graceful, willowy, giant ostrich plumes. Greatly appreciated in far-away countries where they are introduced with difficulty, they are here so common that few stop to appreciate how beautiful they really are.

Shrubs are probably the most abused of any one class of ornamental plants. Who has not seen solitary shrubs standing in line along roads and paths like so many sentinels, prim and stiff, not to say grotesque, and trimmed up like feather dusters from which most of the feathers had been clipped? Sometimes the attempt is made to train a shrub into a tree or some other fantastic shape—with the inevitable result. A man may confess that he is ignorant of other forms of gardening, but he is sure that he knows how to make a hedge and he labors under the

delusion that the hedge is the *sine qua non* in landscape architecture.

As a matter of fact, a hedge is a very serviceable and attractive object *in its place*, and it is sometimes far from unattractive in itself *out of place* if it is properly attended. However the would-be gardener usually "cultivates" it so assiduously with knife and shears that whatever potential beauty the hedge possessed is utterly destroyed and made into hard, ungraceful lines and corners.

The hedge is essentially a windbreak and may be used as a fence or to hide unsightly places, but used on both sides of a road or path it is an abomination, and as unattractive and out of place as a well-arranged border of flowers is attractive and appropriate.

In order to obtain compactness and impenetrability it is necessary every now and then to prune back the hedge; this should always be done with the thought in mind of preserving the natural habits of the plant constituting the hedge as much as possible and yet make it serve its purpose. Among plants eminently well adapted to hedges that also will serve as windbreaks are the oleander, hibiscus, *Acalypha emarginata*, and *Murraya exotica*; for a low hedge, the "violeta" (*Barleria cristata*) is very good.

In most cases shrubs produce the best effects when they are massed; most suitable for solitaires are those of a drooping habit or semiscandent and well covered with foliage from the ground up. *Dama-de-noche* (*Cestrum nocturnum*), *Russelia juncea*, *Acalypha emarginata*, *Pandanus baptisti*, and *P. veitchii* are good examples of shrubs adapted to solitaires; the two last-mentioned species are indeed not shrubs though for ornamental purposes they are used as such, and they may, of course, also be used in massing, either in clumps of one species or intermixed with others.

In massing shrubs the best effects are usually obtained by grouping foliage plants and flowering shrubs in separate clumps instead of mixing them promiscuously. Always place the tallest and most robust-growing species in the background and the smaller ones in front. Especially in a group of shrubs with ornamental foliage avoid planting them in tiers, or the planting assumes an artificial aspect, something that is always to be guarded against.

In making a flower bed avoid intricate and curious designs. A long rectangular bed bordering a walk or a simple circle or an oval in a lawn and triangular beds at the intersection of roads and

paths are the most appropriate designs. Whatever the center of the bed may contain, a border of some dwarf plant with white flowers, for instance, sweet alyssum, is singularly effective; *Pilea* may be used for this purpose, and *Alternanthera* is also frequently employed in a similar way.

Climbing plants may be divided into three classes: The woody semibush form (requiring a wooden frame upon which it is trained); of which the *Bougainvillea* and *Allamanda* are good examples; the herbaceous, twining, or tendril-bearing climbers, such as the many species of *Ipomoea*, *Convolvulus*, and *granadilla*; and the climbers that attach themselves to the object upon which they climb, such as *Bignonia venusta*, *Pothos aurea*, several species of *Piper*, etc. The first-named class can be used to the best advantage in covering unsightly objects, walls, etc. A strong frame should be built upon which this class of plants may climb. The more vigorous species of the second class may be used in a similar way and those of medium vigor are particularly well adapted as porch climbers; the third class is particularly useful in covering walls or the trunks of old trees; they succeed best in shaded situations.

If space permits, a very attractive form of gardening is the rockery, which may be built over a heap of refuse and rubbish in a shady situation with enough good soil in the crevices between the stones on the surface to support and nourish the plants. Ferns and Selaginellas, begonias, tradescantias, various aroids, and similar plants, as well as terrestrial orchids, are particularly appropriate in a rockery. If water is available for a small pond, the rockery as an island in the center with a simulated ruin can be used with telling effect, the pond being planted to water lilies and lotus, with here and there a clump of *Cyperus* on the "shore." Bamboos, coconuts, reclining palms, plants of weeping habit, and tall grasses may be planted in the proximity of a pond.

Hanging baskets always adds distinction to a house, be it large or small; and every house should have a few, either of the bird-nest fern, orchids, or combination baskets of orchids and various ferns. Fern baskets made of strong galvanized wire are most satisfactory and lasting, but good baskets may also be constructed of "longlived" hardwood. Coconut husks make very picturesque receptacles for ferns and orchids, and securely wired with copper or galvanized-iron wire last a long time. For small plants, split bamboo joints are attractive and serviceable, but they decay rapidly.

Before closing, the writer wishes to call attention to the neglect to utilize native plants in connection with ornamental gardening, not confined by any means to the Philippines or the Tropics, but universal the world over.

It is true that many of the best effects are obtained by the grouping together of plants from many countries and climes, but it is also true that many exceedingly ornamental plants, which would be an ornament to any garden, are passed by unnoticed because they are wild and common; such ornamental native plants are particularly desirable because they are already adapted to the climate and are usually easy of culture, not to mention that they usually improve in attractiveness under cultivation.

CURRENT NOTES ¹—SEPTEMBER.

A NEW METHOD OF PROPAGATING CACAO.

It may be of interest to cacao planters throughout the cacao-growing regions to know that it has been found that the cacao can be propagated by the simple means of shield budding. A few cacao plants were set out at the Lamao experiment station some three years ago which have, however, been rather neglected and have not been kept in the best condition. During a visit to the station in November, 1911, it occurred to the writer that the cacao, notwithstanding assertions to the contrary by some writers, might be shield budded, and nine buds were inserted experimentally in three stocks November 19. An examination two weeks later showed that all had taken and the stocks were lopped. The buds promptly made a good start though finally only one in each stock made a good growth. It is, however, significant that none of the buds have dried up and died but are still alive (July 7, 1912). The budwood was fairly well matured and care was taken to insert the buds—which were cut very large—in the stock where the growth was of approximately the same age as the buds; the buds were finally covered with wax-cloth. While an experiment limited to so few buds is not conclusive, still the success attained indicates that continued experimentation is all that is needed to perfect this new method of propagating the cacao. The writer will be pleased to have experimenters in propagating cacao communicate their results to him. (*P. J. Wester.*)

ARGENTINE MAIZE.

Argentina has been producing a tremendous amount of low and medium-grade maize, most of which goes to the European market. Last year, however, realizing that the United States was the country for high-grade maize varieties, that country imported a large quantity of selected seed and the results were so very good that further tests will be made this season. The

¹ Original notes prepared by various members of the Bureau of Agriculture.

present crop is estimated at 8,000,000 tons, which is, say, three-fourths of the European crop and about one-ninetieth of that of the United States.

Since Argentina intends to increase her live stock at the rate of 10 to 15 per cent per annum (it has amounted to only about $3\frac{1}{2}$ per cent of late years), an unlimited supply of maize becomes a practical necessity. There are now some 13,000,000 head of neat cattle, which is pretty nearly the limit of production considering the comparative shortage of the grain ration. The suggestion is now made that a "prudent limitation to the slaughter of cows" be established.

By the way, is there not a great shortage of maize in every country in the world? And is there any country that needs more maize quite so badly as the Philippines? (*O. W. Barrett.*)

AGRICULTURAL EXTENSION WORK.

For several years the agricultural experiment stations and investigators all over the world have been collecting a large amount of valuable information concerning agriculture. That this information has not been effectively used or put into practice by farmers is a well known fact. Recently, however, an effort has been made in several countries to carry this information to the man on the farm through agricultural experts who, knowing local conditions, make periodical visits to the several farms in their respective districts and demonstrate the best methods of cultivation, etc., that will produce the largest yields on these farms.

During the early part of the present session of the American Congress, the Hon. A. F. Lever of South Carolina introduced in that body of legislators a bill known as the agricultural extension work, or Lever bill, the object of which is to appropriate money from the Federal Treasury to the several State agricultural colleges to be used in organizing a department of agricultural extension work. The idea is to have an agricultural expert in every agricultural county in America. A copy of the Lever bill is given here:

THE AGRICULTURAL EXTENSION WORK BILL, OR LEVER BILL.

SECTION 1. An act donating public funds to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts and of the acts supplementary thereto, a department to be known and designated as an agricultural extension department or division.

SEC. 2. That it shall be the object and duty of said agricultural extension departments or divisions to give instruction and demonstration in

agriculture and home economics to persons not resident in said colleges in the several communities, as may be provided by the States accepting the provisions of this act, and to convey and impart to such persons information on said subjects through field demonstrations by persons skilled in the art, and by publications and otherwise.

SEC. 3. That all printed matter for the furtherance of agricultural work as provided in this act, issued from the agricultural colleges receiving the benefit of this act, shall be transmitted in the mails of the United States and dependencies free of charge for postage, under such regulations as the Postmaster-General may from time to time prescribe.

SEC. 4. That for the purpose of paying the necessary expense of maintaining said agricultural extension departments or divisions, and printing and distributing information on agriculture and home economics, as hereinbefore prescribed, the sum of \$6,000 shall be, and hereby is, annually appropriated out of any money in the Treasury not otherwise appropriated, to be paid as hereinafter provided, to each State which shall by action of its legislature assent to the provisions of this act; *Provided*, That payment of such installments of the appropriation hereinbefore made as shall become due to any State or Territory before the adjournment of the regular session of the legislature meeting next after the passage of this act shall be made upon the assent of the governor thereof, duly certified to the Secretary of the Treasury; *And provided, further*, That the additional sum of \$3,000 shall be, and hereby is, appropriated for the fiscal year ending June 30, 1912, to be paid as hereinbefore provided, and an annual increase of the amount of such appropriation thereafter for nine years is hereby authorized by an additional sum of \$300,000 over the preceding year, and the sum to be paid thereafter to the States shall be \$3,000,000 to be used only for the purposes hereinbefore stated; these additional sums to be allotted annually to each State in the proportion which its rural population bears to the total rural population of all the States, as determined by the next preceding Federal census; and, provided further, that no State shall be entitled to any part of its allotment of these additional sums until its legislature shall have provided for the establishment of an agricultural extension department or division in its college or colleges receiving the benefit of this act, and the additional amount to be paid in any year to any State under this act shall be an amount not exceeding the sum appropriated for that year by the legislature of such State for the maintenance of such agricultural extension department or division.

There is no question but that good results will be obtained if the Lever bill becomes law. A similar piece of legislation adapted to conditions in these Islands would also give good results. (*S. H. Sherard.*)

ELEPHANTS IN RINDERPEST REGIONS.

The Philippines are in a way exceedingly fortunate after all regarding the rinderpest situation. This terrible live-stock scourge has been a constant curse to the Asiatic continent for probably many centuries. Rinderpest has undoubtedly shaped the lines of the animal husbandry work to a very great extent.

in both China and India; and indirectly it accounts in a measure for the vegetarian habits of the Chinese people, since many generations have been obliged to get along *without beef*.

In Indo-China the same general conditions prevail as in India and China, on either side; elephants, however, have been in constant use in that country for perhaps hundreds, even thousands, of years. In a recent number of the National Geographic Magazine there appears an excellent article on the ruins of the splendid old temples of Angkor Wat, and carved elephants are much in evidence therein. Apparently it is not generally known outside of that country that the natives of Cambodia and to a certain extent also of Indo-China proper still use elephants as draft and riding animals. Two American gentlemen of the Philippines who recently returned from a hunting expedition into that country, however, were pleased with the riding elephants—practically the only means of conveyance in the hinterland wildernesses—and from their information it appears the cost of keeping two or three domesticated elephants in even the small barrios of the interior is so small that every planter or merchant or official of note maintains one or more of these animals in order to have a proper social standing in the community, as it were.

The mountains of Cambodia and Indo-China are said to be full of wild elephants and from these herds young animals are brought in for domestication from time to time. As in Ceylon, India, and Assam, there appears to be no earnest effort, or possibly no intention, towards the breeding of these animals in domestication; and, in fact, it is worthy of note that even in a country like Indo-China where both tame and wild elephants are almost as common as carabaos in the Philippines, the native's idea of the breeding habits of the elephant are ridiculously crude and probably erroneous. But in this matter the Cambodians are no more exasperatingly obtuse than are the people of India on the same subject—or than almost the entire population of Egypt and Arabia concerning the breeding habits of camels.

Let us remember then that districts like Mindanao could, in case of necessity, fall back on elephants as a reserve element in domesticated animal work. (*O. W. Barrett.*)

RATS.

The unusual number of rats which have infested the Province of Occidental Negros during the past year can probably be accounted for by the lack of dry weather in the early part of 1911.

Ordinarily, fire runs over the uncultivated lands and many of those under cultivation during the season of least rain. It seems probable that these annual fires destroy so many rats as to keep them from becoming a serious menace to the cane planters. At no time in 1911 did the grass in this district get dry enough to burn. Consequently the rats had an opportunity to multiply for two years. It has been estimated that 1 per cent of the last crop of sugar cane in this province was destroyed by rats. It is my opinion that immeasurably greater damage was done by their biting into the stalks, but not killing them. The juice from these damaged stalks, in which more or less fermentation was present, seriously interfered with the manufacture of good sugar; in fact, not many sour stalks of cane would be required to reduce a strike of sugar from No. 2 to No. 3 or from No. 3 to húmedo.

Under the system in vogue among the cane planters of milling their cane "paquiao"—that is, paying so much per picul for milling regardless of the grade of sugar turned out—it is not to be expected that the laborers feeding the mill or placing cane on the carrier will throw out damaged stalks.

The iguana frequently found in our cane fields is believed to feed largely on rats when he can get them. Instead of his being considered a very good friend of the hacendero, he invariably falls a victim to the bolo of some cane cutter. (*H. J. Gallagher.*)

NEW CAMPHOR CULTURE.

Some years ago a new method of producing camphor was proposed for the planters of Texas and Florida: Open field culture of seedling plants, to be cut back at the close of the season and the removed portions distilled. This method is, of course, very distinct from the old distillation of chips of the trunks of the old trees which until late years has been practiced in China, Japan, and Formosa. The theoretical success of this young plant-distillation process in America has led the Japanese Government to adopt a similar method for the new plantations of Formosa.

Whereas in the United States the plan was to cut the field of young plants with an ordinary grass mower, the Formosan planters allow the trees to grow fifteen or twenty years before the leaves are removed for extraction of the gum. The present area of leaf camphor in Formosa is, according to the Daily Consular and Trade Reports, some 4,000 hectares; such an immense area could not be economically handled, of course, without very cheap labor.

There are undoubtedly many sections of the Philippines where camphor would do fairly well, but in the vicinity of Manila the trees make only a very slow growth. In the face of the probable future success of synthetic camphor, and of the drop in price of the Formosan article, wholesale camphor production in the Philippines cannot be predicted. (*O. W. Barrett.*)

NOTES ON PAPAYA.

Some years ago, in 1908 to be exact, the writer called attention, in the *Bull. Torrey Bot. Club* (vol. 35, pp. 141-146), to the differentiation of the structure in the hermaphrodite flowers of the papaya (*Carica papaya* L.), and the correlation of this differentiation to the variation in the formation of the fruit, and to a way to breed up a race of hermaphrodite papayas that would come true to seed. The breeding of the papaya has been subject to considerable attention during the last few years at the Hawaii Agricultural Experiment Station as shown by the annual reports from that station for 1911 and 1912. While they do not discuss the subject in detail, the reports seem in a general way to corroborate the conclusions arrived at several years ago by the writer.

About four years ago the writer had under observation a considerable number of papayas in South Florida, which had been obtained from many different parts of the world. One of these plants bore three distinct types of flowers, (1) staminate, (2) hermaphrodite, with ten stamens inserted in the throat of the corolla, and (3) hermaphrodite, with five distinct petals and five stamens attached at the base of the ovary.

The Bureau of Agriculture has recently taken up the breeding of papayas and some 2,000 plants were originally set out at the Lamao experiment station in connection with this project. In addition to bearing the three forms mentioned, some plants have appeared here with a fourth type of flower, pistillate. A most interesting fact is that the first flowers appearing on the plants possessing this assemblage of different types of flowers were pistillate. As is well known, the first flowers appearing on the ordinary hermaphrodite plants are staminate. Ordinarily the papaya would seem to be entomophilous, the pollen-bearing agents in the Philippines being to some extent a small species of *Coleoptera*. (*P. J. Wester.*)

DANGER TO COCONUTS.

As an instance of the extreme caution taken in regard to all matters pertaining to the coconut industry in other countries,

the new ordinance recently prescribed by the Straits Settlements and Federated Malay States regarding the introduction of the comparatively insignificant coconut pest, described in the March number of the Philippine Agricultural Review, is of much interest.

Aleyrodes citri, the citrus white fly of Florida, is a name which spreads horror among all conservative horticulturists; and of course any similar sounding name, like *Aleyrodicus destructor*, the exceedingly rare coconut pest discovered by Mr. D. B. Mackie, assistant entomologist of this Bureau, about a year ago, is also a frightful name if not a serious pest. This new regulation prohibiting the importation of "any palms alive or dead, or any stems, or foots (roots?), or parts of stems, or roots of palms, or of any products of palms other than such as are expressly exempted from the operation of this order," from the Philippine Islands, shows rather strenuously how alert our neighbors are regarding possible dangers to their coconut groves.

In passing, it may be mentioned that a most excellent coconut pest prevention act has recently been enacted by the Moro Province, which provides for the private or official destruction of all diseased or suspected coconut trees as well as dead stumps or trunks of same.

The Province of Misamis has also recently drawn up a resolution which provides that in case the owner will not fell his own diseased trees, the municipal police may enter the property and take charge of the cutting and cleaning up *with or without* the consent of the owner. The makers of these resolutions looking to the hygiene of coconut plantations cannot be too highly commended. (O. W. Barrett.)

NEW OIL TRACTOR.

The Pacific Commercial Company recently imported a Rumely type "F" single-cylinder oil-pull tractor, and an Oliver four-furrow 14-inch (35.5 centimeter) mold-board plow. This outfit was taken to the Malate park where, on July 19, a public demonstration was given, which was very successful. The tractor is 15 horsepower, weight $7\frac{1}{2}$ tons, and uses kerosene for fuel. It hauled the plow easily, cutting a furrow 7 inches (17.7 centimeters) deep in sod land that had not been plowed for fourteen years. One of the best improvements over other kerosene motors is the automatic carburetor. The motor starts on gasoline, and, after a few revolutions, the kerosene is turned on, and after running a short time to allow the cylinder to warm up, the water is then turned on. After this is done no more attention

need be given to it as the governor controls the motor perfectly when the load is on full, half, or when thrown entirely off, and no adjustments have to be made when the load is put on after the motor has been running light for some time. On the average type of kerosene tractors, when the load is thrown off, the water must be shut off and the kerosene closed down, and when the load is put on again, the carburetors have to be readjusted, and, in case of a double-cylinder motor while running light, one cylinder will be cut out. When taking the load again, the kerosene must be cut off, the gasoline turned on until the cylinder warms up and the process of adjusting commences over again. Often the motor will stop in the effort of taking the load again. All this trouble does not occur on the Rumely. Some of the important features are the extra-heavy frame, all rivetted together, the two speeds forward, the wide range and perfect control of the governor, the principal parts being protected from the sand and dust, and the extra-heavy general construction.

This tractor will be taken to the Calamba Sugar Estate and thoroughly tried out in general farm work. Besides plowing, it can be used for driving pumps, threshers, and other machinery. The results of these practical tests will be closely observed by plantation owners who desire to procure a tractor that will give satisfactory service under the conditions found in these Islands. (*Z. K. Miller.*)

STRANGE STOCK FEED.

Dried locusts are known the world over as good food for both man and beast, and since it is an ill wind that blows no good, a locust swarm really possesses potential advantages in the line of food; so that while we hope there will never be an opportunity therefor, we do believe it possible that dried locusts, either in the hopper or flyer stage, could become a commercial commodity here.

A new cattle and pig feed—herring flour—is recently assuming considerable importance in Europe.

The numerous fjords of Norway are the habitat of millions of tons of fish, and among these the herring is always much in evidence. It is now proposed to utilize the surplus herrings which heretofore could hardly find a market even at very low prices. The oil is, of course, used to substitute linseed for paints and since more than 3 per cent oil in a fertilizer stuff is not only useless but dangerous, the removal of oil from these fish

is necessary before grinding them into flour; thus the herring-flour factory has a by-product, the oil, which is worth more than all the expenses of operation.

Haugesund, heretofore famous for its export of kippered-herring and tinned-herring sardines, is now to receive still further notoriety as the seat of two large, new herring-flour factories. (*O. W. Barrett.*)

HOLT CATERPILLAR MOTOR.

We learn from the Daily Consular and Trade Reports of the success of an American motor in Argentina, as follows:

At an official test of agricultural motors recently held by the authorities of the Province of Buenos Aires, the Orory motor, made by Holt & Co., the California manufacturers of the Caterpillar engine, was awarded the competitive prize. Several entries had been made by foreign firms but before the contest took place they all withdrew, with the exception of Holt & Co. The authorities decided, however, to put the American motor through the various tests, in view of the importance to agricultural interests the matter offered. The motor so completely satisfied all requirements that it was awarded the prize, despite it not being subjected to competition.

Recently, one of these motors was imported by the Mindoro Development Company and taken to their sugar plantation in Mindoro and put in operation. In regard to the work of the motor the manager of the plantation states that as a traction engine, the Caterpillar is superior to everything he has tried out, in regard to both the amount of labor performed and economy of operation.

This statement coming from the manager of one of the largest sugar plantations in the Islands, where several different makes of traction engines have been tried out, should be of special interest to farmers, who are contemplating the purchase of traction engines for use in preparing their land. In the opinion of the writer, this type of motor that has an extra large wheel base will be very successful in preparing moist land that easily packs, or in preparing sandy soil that requires a heavy engine to secure a tractive grip in order to draw the load. The moist clay soils are packed so hard by the heavy engines that they are rendered unfit for the production of crops. The advantage of the Caterpillar type of motor can be readily seen, as on account of the weight being distributed over a large area there is as much tractive force as in an ordinary traction engine of double the

weight, and the tractor should be able to work on land when it is very moist, without sinking in, or packing the soil very much. More definite data in regard to the practical operation of this motor will be given later, as the question of traction plowing is of vital importance to plantation owners, since the growing of sugar cane has assumed such an important position. (*Z. K. Miller.*)

ALCOHOL FROM MAGUEY AND SISAL REFUSE.

The sisal planters have been waiting patiently for the chemists to perfect the processes connected with the production of alcohol from the pulp and juice remaining after stripping the fiber from the leaves; until recently, however, the theory has been good but the practice not very remunerative. A new apparatus utilizing a Barbet fermentation process, a Lawrence cooler, and a regular crushing mill similar to those used for cane, is now recommended in an article in *Der Pflanzer* as the best thing of the kind to date.

It is claimed that 1,000 ripe leaves will yield by this new method about 13 liters of high-grade alcohol and when certain improvements in the fermentation apparatus are instituted, 17 liters will possibly be obtainable. In the future all large sisal plantations will be provided with an alcohol plant, thus saving the residue which heretofore has been not only wasted but a positive danger in the vicinity of the factory. On account of the corroding action of sisal-leaf juice, it must not be allowed to come into contact with tin or iron; the refuse cannot be used even as a fertilizer and it is, of course, useless as a stock food in any form. However, after removing the alcohol from the mixture of pulp and juice, the residue may be mixed with chalk or lime to neutralize the acid and then used for manure.

Another point which makes for great economy on the plantation is the utilization of the stembases, or stumps, of the old plants; it is said that each old stump may be made to yield about $1\frac{1}{4}$ liters of alcohol by the new Barbet method. In Yucatan the life of the hennequen plant is much longer than that of the sisal; in Zambesia the writer has noted a large percentage of the plants (many with leaves of well over 2 meters), in what was perhaps the best sisal plantation in the world, beginning to flower in the fourth year from planting. But even in Yucatan, where plants yield leaf crops steadily for six to eight years or more, it is estimated that on a plantation producing 150,000 leaves daily, there would be some 175,000 stumps to be removed and replaced by young plants each year; and 200,000 liters of

alcohol at even ₱0.10 per liter gives the splendid by-product income of ₱20,000; the leaf alcohol from such a plantation should be worth some ₱70,000.

Wherefore, sisal will probably endure even greater setbacks than it has already met with, and unless abaca can receive some new impetus—as it appears it soon will—the greatest crop of the Philippines will continue to have a very serious rival in the rather unpopular “maguey.” (*O. W. Barrett.*)

PHILIPPINE EXPORTS.

In the latter part of July the Bureau of Customs completed the annual statement of exports for the fiscal year 1912. To agriculturists and others interested in the products of the Philippines these latest figures furnish some very useful and hopeful information. The exportations of copra, sugar and cigars show a marked increase both in quantity and value.

The export of copra for the fiscal year 1912 is 169,342,476 kilos which is an advance of 46.5 per cent over the amount exported during the previous year. Its value is quoted as ₱33,029,498, which is 66.8 per cent higher than last year's value. The greater percentage of increase in value over quantity is accounted for by the increased demand and the consequent rise in unit price of copra. Copra now holds first place among the exports of raw products from the Philippines. Abacá (Manila hemp) is a close second and would still hold the lead if the knotted abacá were included as a raw product. This knotted abacá consists of selected fiber of the best grades, the individual fibers being tied together in long strands suitable for use in the manufacture of textiles. It is classified in the Custom House as a manufactured product. Its export represented a value of ₱300,000 in 1910, ₱1,144,026 in 1911, and ₱1,231,538 in 1912.

Abacá (Manila hemp) dropped from 165,649,626 kilos in 1911 to 153,986,928 kilos in 1912. This loss of 7 per cent in quantity was offset by a rise of 8.5 per cent in unit price which brought the value of the 1912 export up to ₱32,567,020 which is an increase of 1 per cent over last year's value. The advance in the unit price of abacá is due to an increased demand for the fiber. The loss in the quantity of abacá exported is due mostly to the abandonment of some of the abacá fields and their conversion into use for other crops.

As was expected, the sugar export shows a steady gain. A rise of 24.5 per cent in quantity and 29.8 per cent in value brings the 1912 export up to 186,016,489 kilos representing a value of ₱20,801,150. Each year new tracts of land are being

cultivated in sugar-cane and during the year 1912 there has been a slight increase in unit value.

Cigars which fell off 32.6 per cent in their value as an export from 1910 to 1911 have almost regained their place in 1912. The gain over 1911 is 32.6 per cent in quantity and 56.5 per cent in value. The total export in 1912 was 175,319,000 cigars valued at ₱5,320,122. The greater increase in value over quantity is due to the shipment of better grades during 1912.

The export of cigarettes has never been a very heavy factor in the tobacco industry. During 1912, 34,955,000 cigarettes were shipped out, valued at ₱64,976. This was a slight increase in quantity and a decrease in value over the fiscal year 1911.

All other forms of tobacco, such as natural leaf, fillers, wrappers, clippings and chewing tobacco are quoted as 12,547,824 kilos, worth ₱3,805,288. This is an increase of about 0.5 per cent in quantity and 1.8 per cent in value over last year.

The greater demand for Philippine copra, sugar, cigars and other tobacco products is a hopeful sign for the producer and is especially encouraging on account of the accompanying increase in unit value. Even in abacá where a slight loss in quantity is already noted and a greater loss may be expected, the value of the commodity per kilo or per picul has increased and indications at present point to a still further advance. This prosperous condition of Philippine exports has more than offset in money value the increase in rice importations. During the fiscal year 1912 the imports of rice reached 260,249,653 kilos which is 28.2 per cent greater than last year's import of that article. Its value was ₱21,139,898, which is 61.1 per cent above the 1911 import value. This large increase in value was caused by the high prices that rice obtained per kilo and per cavan.

During the fiscal year 1911 there were 203,082,707 kilos of rice imported and 574,842,688 kilos raised in the Philippines. Considering that the two quantities together constituted the entire consumption, then the imports of rice represented 26.1 per cent and the production 73.9 per cent. During the fiscal year 1912 the imports of rice have risen to 260,249,653 kilos and the production will probably be less than 400,000,000 kilos (the exact figures for production cannot be stated at present because many of the reports for the period from January to June have not yet been received). Assuming that the production will reach as high as 400,000,000 kilos, that would make a total of 660,249,653 kilos as the consumption for 1912, an amount 15.1 per cent below the consumption of the previous year. This

would indicate that the people affected by the shortage in the rice crop have to a considerable extent subsisted on other food products. The imports for 1912 would represent 39.4 per cent and the production 60.6 per cent of the total consumption.

A tabulated statement of the imports of rice and the exports of copra, abacá, sugar and tobacco is shown on page 524 of this issue of the Review. These data were taken from the annual report of the Insular Collector of Customs for the fiscal year 1911 and the statement for 1912 as published in the Manila newspapers. (*Benj. P. Lukens.*)

FORMOSAN ACTIVITIES.

All the world knows that Formosa has a corner on camphor. The Japan Government is now installing new evaporators and other machinery to increase the previously limited output of the refined gum. The annual yield, with the contemplated improvements in working order, will probably be about 2,500 tons.

Although Formosa has heretofore produced very little Oolong tea, a venture in the line of green tea is now being made by a Japanese tea merchant, who has erected a factory in Koroton, Taichu.

The production of green tea this year will probably be only some 25 tons, which is almost negligible in comparison with the 12,000 tons of Oolong.

Although sericulture has been carried on for some time in Formosa, it is only recently that the Formosa Silkworm Culture Encouragement Association has been organized by the leading silk merchants of Japan; this company intends putting out some 2,000 hectares in the vicinity of Kagi for growing the mulberries, and a silk factory will be erected in the capital, Taihoku. (*O. W. Barrett.*)

COPRA IN SAMOA.

Samoa probably has a right to be considered the most up-to-date copra country of its size in the world. The German Government has instituted most excellent regulations concerning the preparation and standardization of the raw product, and in the prohibition of picking nuts from the trees has gone on record as taking a firm stand against the very reprehensible practice so prevalent in the Philippines—gathering unripe nuts and mixing the comparatively valueless dried “meat” from such nuts with the matured article.

Although American Samoa, known as Tutuila, with its adjacent Manua Islands, contains only 14,000 hectares (54 square

miles), it exported in the fiscal year 1911 some ₱300,000 worth of high-grade copra to the United States and Japan. (*O. W. Barrett.*)

NEW AGRICULTURAL INSTITUTIONS.

As indicative of the growing interest in agriculture in the uttermost ends of the earth, we note that the Spanish Government is just establishing an agricultural school at Melilla in the recently acquired Spanish section of Morocco.

Likewise, the young King of Siam has just sanctioned a project for the establishment of a University of Bangkok; agriculture will enjoy special prominence among the eight faculties in the said institution.

Lower California has been considered about the "jumping-off place" in the way of agriculture, but it will soon have a new agricultural school at San Francisco de Borja.

An organization for fostering agricultural education has been formed at Bilbao, Spain, under the name "Rural Spanish Society." (*O. W. Barrett.*)

MONTHLY VETERINARY REPORT, JULY, 1912.

By Dr. A. R. WARD, *Chief Veterinarian.*

Antique, Capiz, and Iloilo.—Pandan, Antique, was infected with rinderpest on July 20. Only one town remained infected in Capiz as against five when last report was submitted. Seven towns are infected in Iloilo as against eight when last reported, showing a gain of four towns for the three provinces.

Isabela.—One town known to be infected.

La Laguna.—Two towns are infected as against four when last report was made, making a gain of two towns.

Leyte.—Infection was found in Tacloban on July 24 and in Palo on July 25.

Pampanga.—Only four towns are infected as against seven at the end of June, showing a gain of three towns.

Pangasinan.—Three towns are carried as infected as against only two when last report was rendered.

Rizal.—Three towns are at present infected as against four when last report was rendered, showing a gain of one town.

Surigao.—Hinatuan was declared free from disease on July 23.

Zambales.—Botolan still remains infected.

General conditions.—The provinces of which no mention is made are considered to be free from rinderpest. At the beginning of the period covered by this report there were 12 provinces and 36 municipalities known to be infected while at the present time there are only 10 provinces and 25 municipalities known to harbor infection, showing a gain over last report of 2 provinces and 13 municipalities.

COMPARISON OF EXPORTS AND IMPORTS OF THE PHILIPPINE ISLANDS, FISCAL YEARS 1911 AND 1912.

[Taken from reports of the Insular Collector of Customs.]

IMPORTS.

	1911.		1912.	
	Amount.	Value.	Amount.	Value.
Rice	<i>Kilos.</i> 203,082,707	P13,121,260	<i>Kilos.</i> 260,249,653	P21,139,898
Increase per cent.			28.15	61.112

EXPORTS.

<i>To all countries.</i>				
Copra	115,602,012	P19,798,914	169,342,476	P33,029,498
Increase per cent.			46.487	66.825
Abacá	165,649,626	P32,282,680	153,986,923	P32,567,020
Decrease per cent.			7.0406	
Increase do.				0.88
Sugar	149,376,454	P16,028,720	186,016,489	P20,801,150
Increase per cent.			24.529	29.774
Cigars	^a 132,217,000	P3,401,424	^a 175,319,000	P5,320,122
Increase per cent.			32.599	56.487
Cigarettes	^a 33,662,000	P72,264	^a 34,955,000	P64,976
Increase per cent.			3.841	
Decrease do.				10.085
All other tobacco	12,487,152	P3,737,446	12,547,824	P3,805,288
Increase per cent.			0.487	1.815
<i>To the United States alone.</i>				
Copra	12,240,551	P2,060,962	24,160,029	P4,678,288
Increase per cent.			97.377	126.995
Abacá	66,545,219	P14,820,746	69,573,526	P15,502,978
Increase per cent.			4.551	4.603
Sugar	128,926,454	P14,289,510	161,782,729	P18,285,666
Increase per cent.			25.485	27.966
Cigars	^a 27,936,000	P1,435,814	^a 67,692,000	P3,041,508
Increase per cent.			142.311	111.832
Cigarettes	^a 8,659,600	P30,786	^a 3,849,000	P16,466
Decrease per cent.			55.549	46.515
All other tobacco	14,461	P16,944	4,945	P3,014
Decrease per cent.			65.805	82.212

^a Number.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS—JUNE.

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars United States currency.]

IMPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Total.
Rice	{ Kilos.	32,262,517	7,194,128	2,569,214	42,025,859
	{ Value	1,289,939	306,790	105,323	1,702,052
Beef cattle	{ Number	881			881
	{ Value	19,387			19,387
Sugar	{ Kilos	518,314	52,373	14,283	584,970
	{ Value	41,722	4,231	1,149	47,102
Coffee	{ Kilos	96,935		1,169	98,104
	{ Value	35,409		495	35,904
Cocoa	{ Kilos	102,035	10,401		112,436
	{ Value	31,523	3,095		34,618
Eggs	{ Dozen	396,154	124	83	396,361
	{ Value	29,463	17	15	29,495
Raw cotton	{ Kilos	12,855			12,855
	{ Value	3,374			3,374

EXPORTS.

Hemp	{ Kilos.	15,913,320	898,782		16,812,102
	{ Value	1,761,949	85,476		1,847,425
Sugar	{ Kilos.	1,493,782	32,820	6,723,778	8,250,380
	{ Value	65,674	1,500	306,842	363,916
Copra	{ Kilos	7,731,860	3,564,316	533,327	11,829,503
	{ Value	750,470	371,120	52,892	1,174,482
Cigars	{ Number	18,114,199			18,114,199
	{ Value	296,870			296,870
Cigarettes	{ Number	2,947,100			2,947,100
	{ Value	3,144			3,144
Tobacco	{ Kilos	756,860			756,860
	{ Value	130,103			130,103

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

JUNE, 1912.

(Temperature and total rainfall for 24 hours beginning at 6 a. m. each day.)

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.		Tem- pera- ture.	Rain- fall.	Tem- pera- ture.	Rain- fall.	Aparri.		San Fernando.	
	Tem- pera- ture.	Rain- fall.	Tem- pera- ture.	Rain- fall.					Tem- pera- ture.	Rain- fall.	Tem- pera- ture.	Rain- fall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	30		29.1		29.5	5.3	30.1	48.3	27.4		30.3	
2	30.7	11.9	29.5		30.1		29.6	22.1	27.8		30	
3	29.7	14	28.6		30.4	2.5	29.8	34.3	27.5	17.3	31	
4	29.4		29.2		29.3	27.2	29.1	15.7	27.4		30.9	
5	30		29.2		28.1		28.8	8.9	27.5			
6	30.2		29.6		29.5		29.4	6.4	28.2	3.8		.5
7	29.7		29.7		28.7	21.6	29.9	2.5	28	18.6	29.8	
8	29.2		29.3		28.2		29.4	22.9	27.7		29.9	
9	28.4	1.3	28.7	13.5	27.7	7.9	28.3	3	26.8	18.3	29.9	1.8
10	29.8		28.4	6.1	28.4	5.6	29		28.2		29.7	2.3
11	26.6	6.6	27.9	2.3	26.3	8.4	28.4		27.8		29.8	.5
12	25.8	52.6	28.8		27.5		29.8	48.5	28.6		30.6	18.8
13	27.8		27.2	2.8	27.6		28.2	4.6	28.6	1	29.3	.5
14	29.2		28.6		28.7		29	5.1	27.4	16.2	28.4	22.7
15	29		29		29	2.5	29		28.2	.5	29.2	
16	29.2		29.4	1.5	28.2		29.8		29	.5	29.6	
17	28.3		28.1		29	.3	29.4	10.2	29.6		30.4	
18	28.9		29	.8	29.2	.3	28.9	12	29.3		30.6	
19	29.9		29.1	8.7	29.1		28.6	3	29.8		30.2	31.2
20	29.8		29.2	1.8	28.5		28.6	.5	29.7		28.8	21.6
21	29.9		28.8		28.6	.8	28.7		29.3		29.2	.8
22	29.4	5.6	29		28.4	4.1	29	66	27.5	13	29.7	6.4
23	28.8		29.4		28.6		28.5	16.5	27.9		29.8	8.4
24	29.9		28.8		29		28.6		28.3		28.9	
25	29.6		28.6		28.4	5.1	29.4		29		29.4	
26	29.2		29.1		27.8	8.9	30	16.8	29.2		29.6	
27	29.2		28.9		27.9		29.4		28.6	14	29.8	1.5
28	29.2		29.4		27.4	14.2	29.4		28.3		29.3	
29	28.3	8.6	26.4	17.7	27.5	3.8	29.6		28.4	8.1	29.8	45.5
30	28.8		28.2		27.9		30	16.8	27.3	52.8	28	7.4

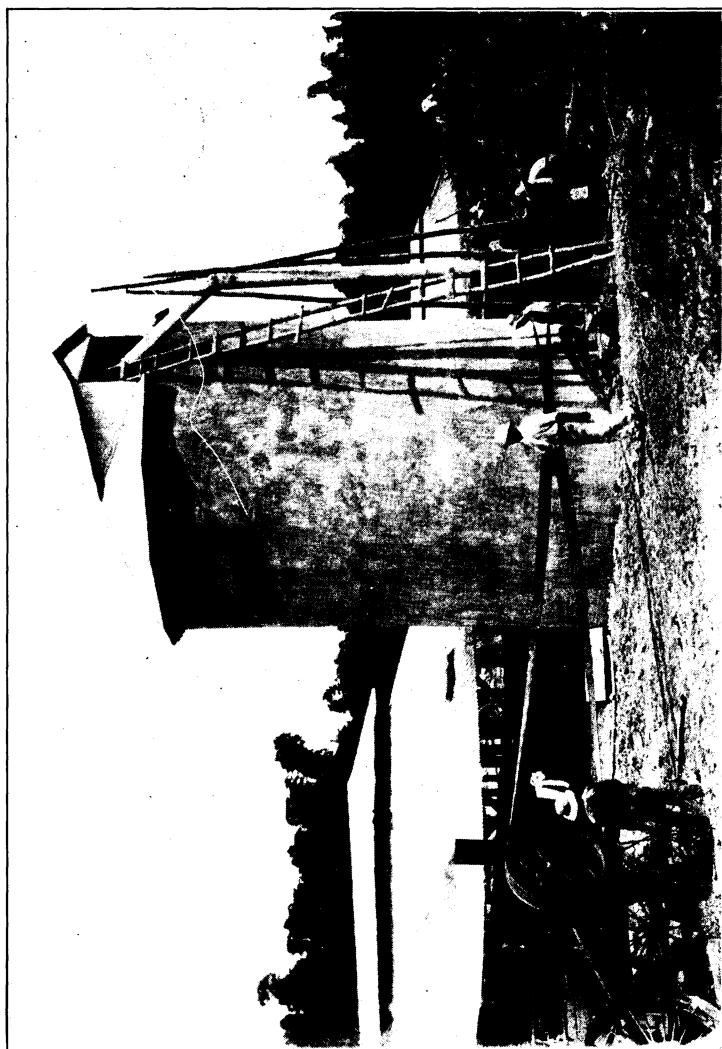


PLATE I.—CIRCULAR CEMENT SILO AT ALABANG STOCK FARM, ALABANG, RIZAL.

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EDITORIAL.

THE PRESENT STATUS OF THE ABACÁ INDUSTRY.

Simultaneously with the gradual fall in the price of abacá since the beginning of 1908 came a gradual decline in the condition of the industry in general. The abnormally high prices paid for the fiber between 1903 and 1907 had caused so much enthusiasm on the part of the planters all over the country that abacá was

planted in any locality, under any conditions, and in any manner. While the price remained high the planters realized large profits, but when the crash came many plantations were found to be so badly neglected, having such poor soils, or managed under such unfavorable conditions, as to make impossible the realization of profits from them without the exercise of judicious methods of cultivation in some and a complete renewal of others. These methods, however, were not practised, and worse than that, whatever little attention had been given to the cultivation of the plants and the quality of the fiber was gradually withdrawn, on the foolish plea that the price of the fiber was too low to justify any such expense or trouble. It was, however, a question of only a few months when the natural consequences followed. The quality of the fiber turned out became so low that the price hardly paid for the expense of cleaning it and transporting it to the market; and the economic standing of the majority of the planters began also to decline gradually, which placed them completely at the mercy of the local buyers, whose status was not affected by the decline in the price and quality of the fiber, except perhaps for the better.

Such has been the general condition of the abacá industry for the past three years. The Bureau of Agriculture, through its fiber office, has made every possible effort to induce the planters to adopt better methods of cultivation and fiber extraction, but there has been no general or widespread improvement. There has always been the danger that a calamity in the form of an unusually severe typhoon or an exceptionally long and severe drought might so seriously and permanently injure the industry as to set it back many years. What was feared happened in the latter form, but fortunately with an apparent tendency to cause an effect directly opposite to the one anticipated.

As far as can be learned, the effects of the recent drought, which is claimed by many to be the severest and most prolonged in the memory of the present generation, was to retard the growth of the abacá plants and thus possibly diminish the production of fiber until the young shoots should have matured. In southern Luzon the effect of the drought was more serious, and it is reported that a large number of stalks fell over, thus permanently injuring the plants. This, however, could have taken place only in those plantations which are either too old or are unfavorably situated, in both of which cases their renewal or transfer to better localities is the only disposition that can be made of them.

In Albay, where the drought wrought the greatest damage, the effect may in one sense be considered a blessing to the province as a whole. It seems to have awakened the producers from their lethargy, and to have inspired them with a clear idea as to what they should do to improve their plantations and their product, and also to better their economical standing so as to render them capable of using improved methods of cultivation, which are the only means of checking the effects of future droughts.

This Bureau is watching with a great deal of interest and concern the recent movement in Albay Province, which is referred to in an article in this number and which is expected to bring about the much needed coöperation among the producers, and also the equally needed understanding between them and the local buyers. This Bureau had in fact called a similar convention in Leyte early in May, but of the two hundred, or more, men invited to attend, only twenty were present. The failure to secure a larger gathering, however, was not altogether due to lack of interest, because the time assigned to the convention was inopportune, it being about the end and most exciting period of the elections. We believe, however, that such conventions should be arranged by the provincial boards and held under their auspices; and this Bureau will, if advised of such a project, be glad to send a competent official who will be able to help in an advisory capacity. The conditions of the abacá industry in the other provinces are very similar to those in Albay, and similar attempts to bring about coöperation and understanding between the producers and local buyers in them will also result in a distinct advantage to both parties and in restoring the abacá industry to its former condition of prosperity.

CIRCULAR No. 16.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE.

MANILA, P. I., *July 7, 1912.*

PINEAPPLE CULTURE.

By P. J. WESTER, *Horticulturist.*

INTRODUCTION.

The exact date of the introduction of the pineapple into the Philippines is not known, but it was introduced many years ago by the Spaniards and plants are now widely scattered throughout the different islands in the Archipelago, where in many places they grow and flourish without any attention. It is, therefore, rather strange that a plant so easily grown and propagated, with a fruit that ranks as one of the best flavored of those of the Philippines, is but slightly cultivated for its fruits, one province only (Bataan) producing pineapples for the market to any great extent. In the other principal pineapple-producing provinces, Samar, Occidental Negros, Tayabas, Bulacan, Leyte, Cebu, and Zambales, the plant is grown more for its fiber than for its fruit. A comparison of our soil and climate with those of pineapple-growing countries in other parts of the world, and a consideration of the behavior of the pineapple in the Philippines, give assurance that with proper care the pineapple will succeed equally well in many parts of the Archipelago.

The pineapple belongs to a family of air plants, and therefore succeeds best in a light, open, sandy, friable, well-drained soil, where there is a precipitation of about 1,500 to 2,000 millimeters falling mainly from June to November. Lacking natural rainfall, irrigation will answer; a judicious amount of water applied during the formation of the fruit will assist in the production of larger and juicer fruits, but water used in excess during the last stages of the ripening produces a watery fruit of poor keeping qualities.

VARIETIES.

The native pineapple is of excellent flavor, but is not always well proportioned; it has too large a crown and too many slips attached to the fruit at the base, and the eyes too deep-set, which are moreover frequently affected with eyeroot, to make it a good variety to plant either for marketing as a fresh fruit or for canning.

In Hawaii and Singapore, the two principal centers for pineapple canning, the Smooth Cayenne, or as it is now called, Cayenne, has long been recognized as the variety best adapted for canning purposes; in fact, it has no rival at present as a canning fruit. This variety is just being introduced into the Philippines and there is every reason to believe that it will succeed as well here as in Hawaii and Singapore. For marketing fresh in near-by towns the Cayenne will be found excellent; for distant shipments, to China and Japan, a hardier variety, such as the Spanish, may be found preferable.

Excellent varieties for the home market are also the Queen (introduced by the Bureau several years ago), the Cabezona, Sugarloaf, and Abakka; the introduction of these latter varieties is now being arranged for by the Bureau of Agriculture.

SOIL.

As already stated, a sandy open soil is best adapted for the pineapple; however, with favorable climatic conditions and proper cultivation the plant succeeds well in heavy soil also. Well-drained land is essential.

Wherever this is practicable, land selected for a pineapple plantation should be free from nut grass or other weeds whose control is difficult. It is good practice to begin the clearing of the land at the advent of the dry season, and after all roots and trash have been removed to turn the land frequently in order to destroy the last vestige of any noxious weeds that may be present. This is particularly desirable where the land is infected with the nut grass or joint grasses.

While this may be done to advantage at all times, it is doubly advisable, not to say necessary, to plant the newly cleared land, where this is infested with noxious weeds, with a leguminous cover crop the first year to choke out the weeds. The Lyon, or velvet, beans are particularly well adapted for this purpose. The land having been cleared and in good tillable condition, the seed should be planted with the advent of the first rains in order to give the plant a good start and enable them to

cover the land before the weeds make headway. If the seed is good, about three beans may be dropped in each hill, the hills being 1 meter apart in the row and the rows the same distance apart. If the viability of the seed is poor, more seed should be planted in each hill. Shallow cultivation is beneficial until the plants begin to cover the land well. At the end of the season the growth should be plowed under and the land prepared for setting out the pineapple plants. For the best results, and to expedite the planting, it is essential that the land be thoroughly cleared of all roots, weeds, and trash before the planting is begun.

PLANTING.

There are several methods of laying out a pineapple plantation, each adapted to the character of the land on which the plants are to grow. If the land is fairly porous or sloping—so that the surplus water escapes easily, either through the soil or by running off on the surface—and free from noxious weeds, the bed systems are the most preferable. Under this term two methods are used: (a) The narrow bed, and (b) the wide bed. In the narrow-bed systems, the land is marked off into rectangular beds 60 or more meters long, to suit the convenience of the planter, each bed containing six rows of plants 45 to 60 centimeters apart, the plants set out at the same distance in the rows respectively, the pathway between the beds being 135 to 180 centimeters wide. This system allows the weeding of the plants and their fertilization to be done from the pathway without stepping into the field; the fruit may also be gathered from the pathway. In the opinion of the writer this system is preferable to the one described below.

According to the wide-bed system the beds are laid off 10 to 15 meters wide, the plants being set out at the same distance as already indicated in the description of the narrow-bed system, the pathways being somewhat wider. In using this system it is necessary, in the weeding and fertilization of the field, to walk in the bed, and in the gathering of the fruit one man walks through the field breaking off and tossing the ripe fruits to a "catcher" who walks abreast in the pathway.

For flat lands, with heavy soil, where water is apt to become stagnant during the rainy season, and on lands infested with troublesome weeds necessitating frequent weeding, the single and double row systems have been advocated, but it is believed that the advantages derived from the use of either of these systems may be had by the use of a three-row bed with the

additional advantages that more plants can be grown on the same given area and that there is less danger of scalding the fruit through its falling over. In using either the one, two, or three row system, in order to secure better drainage, the land should be bedded up by plowing, throwing furrows together, so that the pathways drain away the surplus water from the land. The pathways should be not less than 120 centimeters wide from row to row.

Whichever system is used, the pathways should be crossed by roads of a convenient width—6 to 10 meters—at suitable distances, in which may be located tramways for the carrying of the fruit to the packing house; on large plantations the tramways should be provided with switches and convenient turntables, in order to facilitate the handling of the fruit trucks.

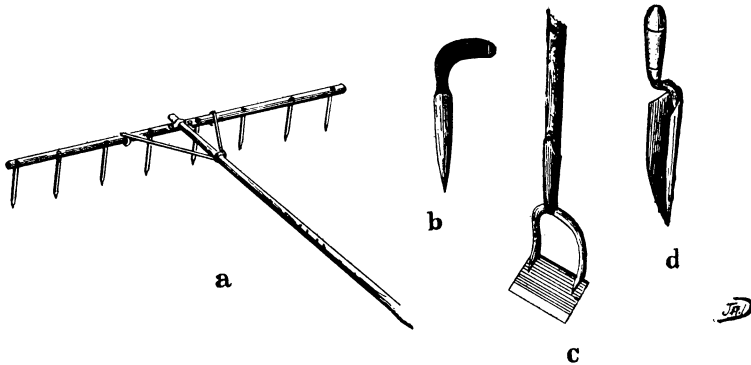


FIG. 1.—Useful implements in pineapple culture: (a) Marker; (b) dibber, for planting in loamy soil; (c) scuffle hoe; (d) garden trowel, for planting in sandy soil.

The land being staked off, the beds are laid out with a marker (See Fig. 1, a) which is dragged lengthwise and crosswise over the field, and the plants are set out where the lines meet each other at right angles. The marker may be made of scantlings 3 by 10 centimeters, or of bamboo, and should be about 4 meters wide, and may be described as a very large wooden rake having the teeth very far apart, from 45 to 60 centimeters, according to the distances it is desired to set out the plants in the beds, the minimum distance being used for the small-growing varieties such as the Spanish. The Cayenne should be planted 50 to 60 centimeters apart. At no time should the plants be set out more than 75 centimeters apart, partly because it is a waste of land, partly because the plants cannot cover the land adequately, allowing the free growth of weeds, which increases the work of weeding, and lastly because the

plants then stand too far apart to support each other and the fruit falls over and is apt to become blistered. On dry, sandy land, a garden trowel (Fig. 1, d) is the best implement to use in setting out the plants; on heavier lands, where the soil does not run and fill up the hole, a dibber (Fig. 1, b) can be used to the best advantage.

Practically all pineapple plantations are set out with suckers, which grow out in the leaf axils of the old plant after the fruit is harvested, or slips, which are little plantlets that surround the fruit at the base. The suckers or slips should be prepared for

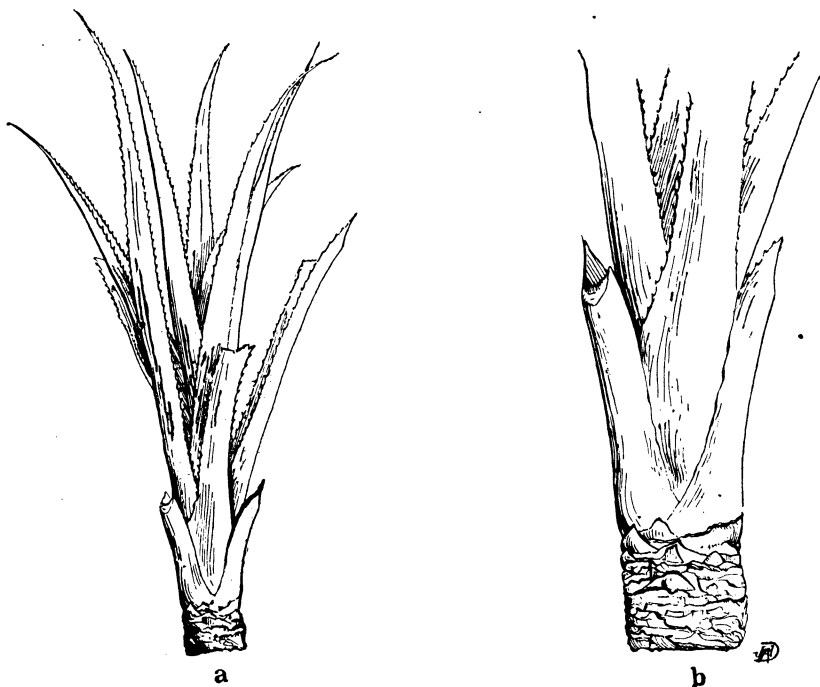


FIG. 2.—(a) Pineapple slip prepared for planting; (b) the base of the same slip.

planting by cutting off any diseased, injured, or insect-infested part of the base, and by stripping the lower leaves, under which the stem is mature and has a brownish tinge with the tiny roots protruding (Fig. 2). This assists the young plants in more rapidly establishing themselves, and prevents them from contracting the disease known as "tangleroot." Care should be taken not to strip too close, thus exposing the white, tender part of the stem, as this weakens the plant and frequently kills it. Unlike other plants, it is impracticable to transplant old pineapple plants retaining the existing root system; the old root

system should be cut away and the plant set out like a sucker and allowed to make a new root system.

Where a shipment of plants has been long in transit, say, three weeks or longer, it is well to spread out the plants in a shady place for a few days before they are set out in the field, in order to accustom them to the change.

Where the plants are dependent upon the natural rainfall only, they should be planted at the approach of or during the rainy season, so as to enable the plants to become established, unless the land contains a reasonable amount of moisture throughout the year. On irrigated land, plants may be set out at any season.

In Florida it is necessary to drop a mixture of cotton-seed meal and tobacco dust in the heart of each plant as it is set out to prevent "sanding," but judging from the observations made last year, this does not seem necessary in the heavier and more compact soils in the Philippines, and in this more favorable climate, which aids in a correspondingly more rapid growth of the plants, enabling them to overcome untoward conditions. In sandy soils this use of meal or dust may be found expedient even here, however, for which purpose a mixture of lumbang cake, tobacco dust, and sawdust in equal parts is recommended. Only a small amount should then be dropped in the center of each plant, enough to cover the young leaves.

CULTIVATION.

Until the plants begin to cover the ground and choke out the weeds, the land should be frequently weeded with the scuffle hoe (see Fig. 1, c) or the ordinary hand hoe, the scuffle hoe being preferable on light, sandy soils, the other being more suitable for heavier soils. No cultivation is practicable, or indeed necessary, after the plants cover the ground well, where the bed systems are used, the idea being that planted close, the plants will choke out all smaller weeds; the few larger ones are hand pulled. These systems of planting and cultivation have succeeded well in south Florida on the extremely sandy soil that is characteristic of that part of the State. Artificial fertilizer is there used very extensively, being thrown broadcast over the plants and washed down by the rains, it being impossible to work it in with a cultivator or hoe.

After the fruit is harvested the field should be cleaned of weeds and diseased plants. Where the wide-bed systems are used the plants are, as has already been stated, relied upon to

choke out the small weeds, the large ones being hand pulled. All diseased plants should be removed and the vacant land planted to strong, healthy slips or suckers. The slips and suckers should be removed as soon as they are large enough to set out. Two suckers should be left on each plant to produce the next season's crop. The lower ones are retained; those growing higher up on the plant are removed, as the fruit produced on them is most apt to fall over and become sun scalded.

The length of time a plantation will remain productive depends largely upon the fertility of the land, the variety cultivated, and the care accorded the plantation. In strong, heavy, and weedy land the plantation may be expected to remain profitable for three or four years before it is replanted. On lighter soils which are free from troublesome weeds a plantation may, with good care, remain productive for eight to ten years, or even longer under favorable circumstances. When it becomes necessary to replant the field, the old plants should be torn out and the field planted to a vigorous-growing legume such as the Lyon or velvet bean, *Canavalia* or cowpea, which is plowed under and the land is then again reset with pineapples. In very weedy fields, it may be found advantageous to plant twice with a cover crop in order to effectually suppress the weeds.

On bedded lands that are apt to wash badly during the rainy season, the soil should be thrown back into the bed around the plants to a depth of 7 to 10 centimeters. This supports the old plants as well as assisting in the formation of a new root system in the fresh soil.

FERTILIZATION.

In Florida the pineapple fields are heavily manured with artificial fertilizer and its use has also been found beneficial in Porto Rico and Cuba, and it is probable that the application of artificial fertilizers will pay in the Philippines also. No fertilizer experiments having been as yet conducted in the Philippines with the pineapple, definite advice cannot be given on this subject.

The following suggestions are offered from the experience accumulated by the growers in the West Indies and Florida, which, it is believed, cannot lead us far astray. At the same time all growers are urged to set aside a part of the field for fertilizer experiments in order to determine which is the most suitable for their particular soil and locality. In such work the Bureau of Agriculture will be glad to coöperate and assist in every way in order that as much light as possible may be shed on this important subject.

The following artificial fertilizers, which have been found beneficial, and which are without any deleterious effects, even when thrown broadcast over the growing plants, may be obtained in Manila. They should not be applied when the plants are coming into flower, or deformed fruits are liable to result.

Name of fertilizer.	Composition.		
	Nitrogen.	Potash.	Phosphoric acid.
	Per cent.	Per cent.	Per cent.
Dried blood	14.5		
Tankage	4.		22
Paniqui guano	8.5		3
Bonemeal	5.		20
Sulphate of potash		49	
Basic slag			20

The mixtures recommended below are based upon the supposition that the ingredients have the above analysis. If a certain ingredient has a different analysis, the amount applied should be greater or less corresponding to the analysis of the fertilizer.

Basic slag should never be mixed with any organic fertilizer, such as dried blood, tankage, guano or bonemeal as the lime contained in it liberates the ammonia in the other constituents.

First application.—The first application may be made shortly after the plants have been set out and should consist mainly of a nitrogenous plant food, such as dried blood or lumbang cake. About a heaping tablespoonful of dried blood is sufficient, and should be dropped around each plant. The lumbang cake being less concentrated, more than twice this amount may be applied of the fertilizer. Paniqui guano may also be used though it contains rather an excessive amount of phosphoric acid. When the plants are established and become of fruiting age, they require potash and phosphoric acid in addition to nitrogen in order to do their best; in fact, the second application should be a well balanced fertilizer. For this purpose the application of 45 kilograms of nitrogen, 80 kilograms of potash and 36 kilograms of phosphoric acid per 10,000 plants per year is recommended in applications and quantities as will be mentioned presently.

Second application.—This application should be made two to three months after planting and supply 18 kilograms of nitrogen, 18 kilograms of potash, and 9 kilograms of phosphoric acid in the following quantities:

Dried blood	kilograms....	125
Sulphate of potash	do.....	35
Basic slag	do.....	45

or,	Dried blood	kilograms....	115
	Sulphate of potash	do.....	35
	Tankage	do.....	40
or,	Paniqui guano	kilograms....	200
	Sulphate of potash	do.....	35
	Bonemeal	do.....	15
or,	Dried blood	kilograms....	110
	Sulphate of potash	do.....	35
	Bonemeal	do.....	45

Third application.—The third application should contain 13.5 kilograms nitrogen, 27 kilograms potash, and 13.5 kilograms phosphoric acid, and should be applied six months later which will be in April or May provided that the plants were set out in July or August.

	Dried blood	kilograms....	90
	Sulphate of potash	do.....	55
	Basic slag	do.....	65
or,	Dried blood	kilograms....	70
	Sulphate of potash	do.....	55
	Bonemeal	do.....	65
or,	Paniqui guano	kilograms....	140
	Sulphate of potash	do.....	55
	Tankage	do.....	40
or,	Dried blood	kilograms....	75
	Sulphate of potash	do.....	55
	Tankage	do.....	60

Fourth application.—The fourth or last application should be made about two months before the advent of bloom or in October or November for plants set out fifteen to sixteen months previous. Nine kilograms nitrogen, 45 kilograms potash, and 13.5 kilograms of phosphoric acid should be applied, as follows:

	Dried blood	kilograms....	62
	Sulphate of potash	do.....	90
	Basic slag	do.....	65
or,	Paniqui guano	kilograms....	85
	Sulphate of potash	do.....	90
	Tankage	do.....	50
or,	Dried blood	kilograms....	40
	Sulphate of potash	do.....	90
	Bonemeal	do.....	65

or,

Dried blood	kilograms....	45
Sulphate of potash	do.....	90
Tankage	do.....	60

Subsequent applications.—After the plantation is well established and has produced its first crop, 27 kilograms of nitrogen, 26 kilograms of potash, and 18 kilograms of phosphoric acid should be applied in the following combinations as soon as practicable after the fruit is gathered:

Dried blood	kilograms....	185
Sulphate of potash	do.....	75
Basic slag	do.....	90

or,

Dried blood	kilograms....	150
Sulphate of potash	do.....	75
Bonemeal	do.....	90

or,

Paniqui guano	kilograms....	290
Sulphate of potash	do.....	75
Bonemeal	do.....	45

or,

Dried blood	kilograms....	160
Sulphate of potash	do.....	75
Tankage	do.....	80

The following amounts of fertilizer, supplying 18 kilograms nitrogen, 54 kilograms of potash, and 18 kilograms of phosphoric acid, will be found useful before fruiting:

Dried blood	kilograms....	125
Sulphate of potash	do.....	110
Basic slag	do.....	90

or,

Dried blood	kilograms....	100
Sulphate of potash	do.....	110
Tankage	do.....	80

or,

Paniqui guano	kilograms....	170
Sulphate of potash	do.....	110
Bonemeal	do.....	65

or,

Dried blood	kilograms....	95
Sulphate of potash	do.....	110
Bonemeal	do.....	90

The formulas and amounts recommended above have been used on sandy soils in the West Indies and it is probable at least that much of the land in the Philippines does not require such heavy applications; particularly is it likely that in loamy soils with

a fair amount of humus, the nitrogen may be omitted or very small amounts used after the plants are well established.

A luxuriant growth of the plants with few fruits indicates an oversupply of nitrogen in the soil; in such cases, a good application of potash, say, 90 kilograms of sulphate of potash analyzing 49 per cent, applied three weeks to a month before the advent of bloom will be found beneficial.

YIELD.

The yield depends upon so many factors that it is difficult to make a definite statement. With intelligent cultivation and favorable climatic conditions, from 75 to 85 per cent of the plants may be expected to bear fruit; some growers in Florida frequently obtain over 95 per cent.

HARVESTING.

No hard and fast rule can be laid down as to when the fruit should be gathered, as this depends upon the distance the fruit will have to travel before it reaches the consumer. In any event it must be picked not later than when it begins to "show color" for long-distance shipments, or even quite green. This is something that every grower must determine for himself. If grown for canning purposes, as undoubtedly it principally will be in the Philippines, with the factory near the plantation, the fruit should be gathered as soon as as it is fairly well colored.

Great care should be exercised in handling the fruit and to avoid crushing it, as in the event that the fruit is shipped fresh to distant markets, if bruised, it will have spoiled and become unsalable before arrival, and even canned fruit, injured before the canning process, does not make a first-class product.

Excepting for near-by markets, the fruit, if it is picked during the dry, warm season, should be placed in a cool, dry, open place over night to cool off before it is packed. Fruit that is gathered during wet weather must be dried before being packed. For this purpose set the fruit upside down so that the water can easily drain off the crown.

Fruit that is intended for long-distance shipments should be packed in well-ventilated boxes of a convenient size for handling, and the crates should be made as light as possible commensurate with sufficient strength to stand the handling during transit. In Florida, Porto Rico, and Cuba a crate approximately 25 by 30 by 90 centimeters is used extensively. The fruit is there graded to the following sizes: 18, 24, 30, 36, and 42, according to the

number of fruits that are packed in each crate. Each fruit should be wrapped separately in tissue paper. The object in grading, sizing, and wrapping is to obtain a uniform and attractive pack, for such fruit always brings a better price than when the fruit is packed promiscuously and carelessly. Care should always be taken to pack the fruits so that they never shake in transit.

When the fruit is grown for canning, it is, of course, delivered in bulk and the sorting done at the cannery.

In a cannery the chief product will always be canned fruit, but it should not be forgotten that there is also a considerable demand for crushed and grated fruit, that there is a good demand for pineapple flavoring extract, and that excellent wine may be made from the fruit, in the making of all of which products much of the culls and injured fruits can be utilized.

INSECT PESTS AND DISEASES.

Grown on a soil adapted to its culture and receiving the proper care, few plants are so exempt from insect pests and diseases as the pineapple. Sifted down, the really serious troubles of the pineapple are the mealy bug and wilt. The red spider sometimes appears in sufficiently large numbers to be regarded as a pest.

The mealy bug is the only insect pest of importance; it attacks the leaves at their base and is usually distributed by ants. At the Porto Rico Experiment Station a kerosene and crude carbolic acid emulsion was found to be an effective remedy for this insect, prepared according to the following formula:

Kerosene	liters....	15.0
Crude carbolic acid	do.....	.9
Soap	kilogram....	.5
Water	liters....	7.5

Dissolve the soap in boiling water, together with the carbolic acid, and while still hot add the kerosene. Churn the liquid steadily for fifteen or twenty minutes by the use of a force pump, the liquid being pumped back into the vessel until it is emulsified. For spraying, dilute each liter of the emulsion with 18 liters of water.

In spraying for mealy bugs, it should be remembered that the force of the spray should be sufficient to penetrate the mealy covering of the insect and saturate its skin in order to be effective. It is, therefore, necessary to direct the spray into the heart and between the leaves of the plant. The ants should also

be eradicated by spraying into their nests. In order to reach all it is usually necessary to spray the nest two successive days.

If the plants are suffering from a very serious attack and the affected area is not large, perhaps the best remedy is to take out the plants and burn them, insects and all.

Red spiders sometimes cause injury during prolonged dry weather, but they are readily exterminated by the use of tobacco dust, which is scattered over the plants. Like the mealy bug, the red spider attacks the plant at the base of the leaf.

The pineapple scale has never been known to occur in sufficient numbers to cause serious trouble.

The wilt is due to a fungus (*Fusarium* sp.). This disease is characterized by the loss of color in the leaves, which change from green to a sickly red and yellow, at the same time shriveling and wilting.

The organism that causes the wilt inhabits the soil and the disease cannot, therefore, be treated like ordinary fungus parasites.

All diseased plants should be pulled out and burned, and the land affected covered with quicklime and left to lie fallow. The soil should in the meantime be stirred from time to time. After two months the land may again be reset with healthy plants. Under no circumstances should plants suspected of having the wilt be set out in a new field.

Sun scald or blistering is not a disease and is caused by the falling over of the fruit so that one side of it is exposed and blistered by the direct rays of the sun. The sun scald can be prevented by shading the fruits that have fallen over with handfuls of straw or grass.

Tangleroot is a condition of the roots caused sometimes by the failure to strip the slips or suckers before they are set out, or by hard soil which cannot be penetrated by the roots. It is characterized by the roots winding around the stems instead of growing out in the soil. The remedy is preventative and consists of sufficient stripping of the basal leaves of the plants at the time of planting and thorough preparation of the land.

Spike is a physiological trouble induced by the use of improper fertilizers, such as acid phosphate, kainit, and wood ashes, the use of which should be avoided.

In conclusion it may be said that if the suggestions offered in this paper are properly carried out, there is apparently no reason why pineapples cannot be successfully grown in the Phil-

ippines. The cost of planting and cultivation and the profits have not been discussed here for the reason that these depend upon so many variable factors, such as the condition and price of land, cost of planting and of labor, accessibility to the market, etc., that estimates would be of little value.

Great care should be exercised in importing plants from abroad in order that no new serious insect pests or diseases may gain entrance into the Archipelago, for with the entrance of each pineapple pest, the profits of a pineapple plantation are reduced correspondingly.

CIRCULAR No. 17.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE.

MANILA, *July 28, 1912.*

CORN CULTURE.

By SAM H. SHERARD, B. Sc., *Agricultural Inspector.*

SELECTION OF SEED CORN.

Soil, climate, and the length of the growing season vary so much in different countries and in portions of the same country that it is very important that corn should be bred up in each neighborhood. If we bring seed corn from another country and plant it directly in our fields, we will not get a maximum yield the first year because the seed was not acclimatized, nor was it "at home" in our soil. If, however, we select the best ears of those produced the first year and plant kernels from them in our field the next, we will get a better crop of corn than we did the first year because the seed used in the second planting is more accustomed to our soil; if we keep selecting the seed from the best ears each year, after a while we will have produced a variety of corn that is suited to the Philippines and will produce more per hectare than any other kind. In a like manner if we select the best ears from the varieties of corn at present growing in the Islands and use them for our next seed, we will get a larger yield than if we had not selected the seed.

Any planter who produces a strain of corn that is well adapted to these Islands will be able to sell good seed at a price profitable to his neighbor as well as himself, and he will be a benefactor to his locality by increasing the production of corn therein.

The object in selecting seed corn is to produce a variety of corn that will make more shelled corn per hectare than has ever before been produced in the Philippine Islands.

The seed (kernel).—A kernel of corn contains a very small germ which, when planted, will make a stalk of corn, and if the seed we use is not the best, in a short time the strain will "run

out," and we will harvest a small yield of ears. The stalks will be scrubby and yellow with only undeveloped ears on them. Then, too, unless we select good ears for seed, disease and insect enemies will develop to such an extent that corn growing will become unprofitable.

A good stalk of corn.—Since the stalk is the individual, it is therefore necessary to select seed ears from stalks that are well

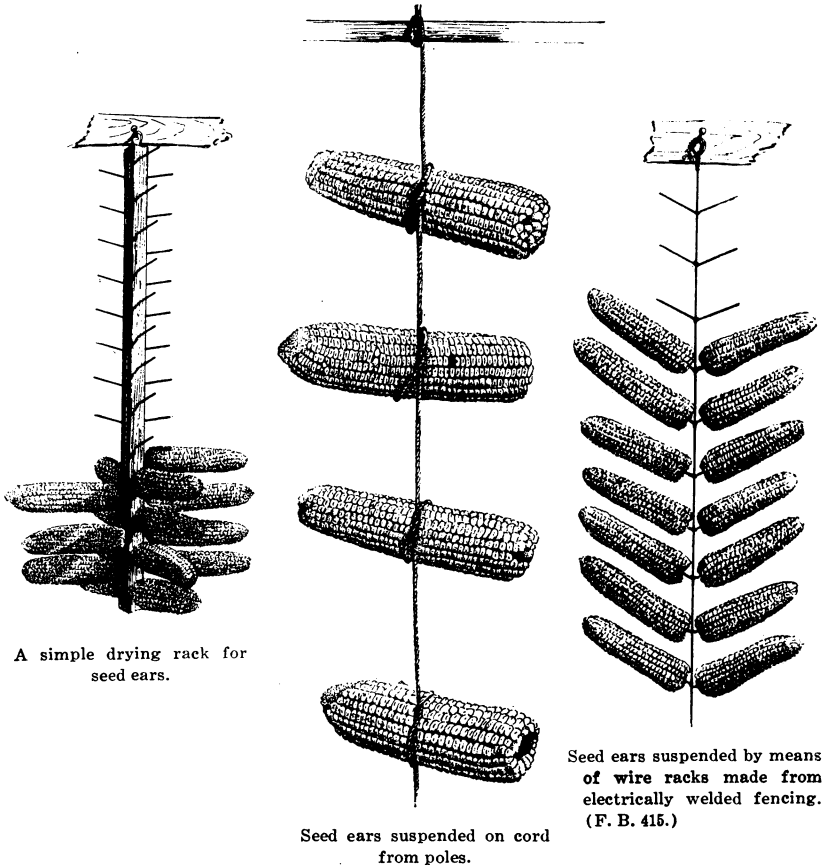


FIG. 3.—Method of Treating Seed Ears.

developed, and this can be done only by selecting from standing stalks in the field at ripening time. Thus we are able to select seed corn from stalks that have produced heavily under average field conditions and in competition with other stalks in the same field.

In the Philippines a good stalk of corn should be between 2.5 and 3 meters high without suckers, thick at the base, with

well-developed roots, and gradually tapering toward the top. The stalk should be free from "smut" or other diseases and should have from twelve to sixteen well-formed blades and two good ears attached by an ear stalk or "shank" 8 centimeters in length. The ears should be 120 centimeters from the ground, should be well covered by the husk, to guard against weevils, and should point downward.

A good ear.—The ear should be nearly cylindrical in shape, well rounded at each end. The rows of kernels should be straight and compact, commencing close to the "shank" and extending clear over the end of the cob to the tip. The cob should be neither too large nor too small. It should be about one-half the diameter of the ear at a distance of one-third from the butt. The kernels should fit snugly and be uniform in size; be nearly flat on the sides, fairly long, and slightly tapering on both edges or "wedge shaped."

Selection in the plat.—When the ears have silked, go through the plat and cut down all stalks that have not started an ear. Then, just before harvesting, go through the plat again and select and mark those stalks that have two good ears on them. Later on, when ready for harvest, these selected ears should be removed from the stalks with the husks on, and should be placed in a dry place where weevils and rats cannot get at them. They should be examined from time to time to see that they are dry and that insects and vermin have not molested them.

Before planting time the seed ears should be tested by planting five grains or kernels from different parts of each in a germination box.

TESTING SEED CORN.

Three hundred and two thousand, five hundred and sixteen hectares of land were planted in corn in the Philippines in 1911 and 186,404,700 liters of shelled corn were produced in that year, an average of 616 liters per hectare. This is indeed a very poor average!

Though some provinces produce only four cavans per hectare, practically every province in the Archipelago can be made to yield over thirty cavans per hectare if more attention is paid to the cultivation of the growing crop and to the selection and testing of all seed corn that is to be planted in our fields. If each kernel of corn that is planted germinates and makes a vigorous stalk, we will have a good stand of stalks in the field. If this happens all of the ground will be occupied, and in cultivating no time or

labor will be spent in working those places that contain vacant hills. Now in order to get a good stand of stalks in our fields, we must plant corn that will produce a good stalk for each kernel planted, and to get such, it is necessary to test our seed corn at home. This can easily be done if the following instructions are carried out:

A home-made germinating box.—Take an ordinary box 30 centimeters wide and 45 centimeters long and saw off the top part so that the bottom will have sides 7 centimeters deep. Cut holes in the bottom for drainage. Fill this tray with sand, then level it and mark off into 5-centimeter squares. By driving tacks 5 centimeters apart on the sides and ends of the tray and running twine across, this can be effectively done. Number the ends and sides from one to ten. Next take the ears that are to be tested

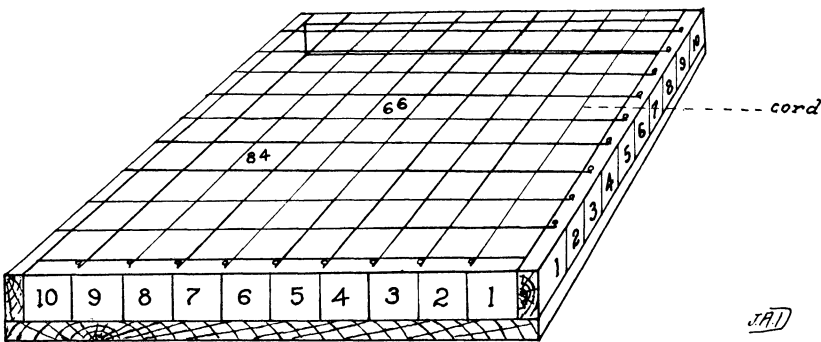


FIG. 4.—A Homemade Germinating Box.

and arrange them side by side on the floor or ground with the butts toward you. Now pick out the most desirable ears and number them to coincide with the numbers of the squares in the tray. Then grasp ear No. 1 firmly in the left hand, pointing the butt away from the body, and with a dull pocketknife or similar instrument remove a kernel 4 centimeters from the butt and place it 2 centimeters deep in one corner of square No. 1; give the ear a quarter turn to the right and take another kernel about 7 centimeters from the butt and place it in another corner of square No. 1; give the ear another turn and take a kernel 7 centimeters from the tip and place it in another corner of square No. 1; give the ear still another turn and take a kernel 5 centimeters from the tip and place it in the remaining corner of square No. 1; then turn again and take a kernel 3 centimeters from the tip and place it in the middle of square No. 1. The ear

has now been turned completely around and five kernels have been taken from different parts of it. Now take ear No. 1 and put it in a place where it will not be moved or get mixed with other ears. Then take ear No. 2 and remove the kernels in the same way as from ear No. 1 and place them in a similar manner in square No. 2. Continue until all ears have been treated. Then take a sprinkling pot and thoroughly wet the sand in the tray; then place the tray in a shady spot and water it from time to time. In from five to seven days the kernels will have germinated. Examine each kernel in every square; and if all have vigorous sprouts, each ear has germinated 100 per cent and we have good seed corn; however, if more than one kernel in any square has failed to germinate and produce a healthy plant, do not use the seed from that or those ears for seed.¹

What the germination test will show.—The germination test shows that the kernels from several ears do not sprout at all; these ears are dead. The sprouts from some of the ears are short and sickly. Such seed will not grow if conditions are at all unfavorable. The kernels from some ears throw out strong, vigorous sprouts. This is the kind of seed that makes a good stand, even if the season is unfavorable, and the plants are strong and vigorous throughout the growing season. It is only from seed from such ears that a high yield can be secured.

GOOD SOIL FOR CORN.

What is soil?—The soil is a very interesting thing. It is not only a place to support plants to keep the wind from blowing them over, but it is also a great laboratory, a storehouse, a place where miracles are worked. The soil is a living thing. A good soil has a vast number of bacteria or living microorganisms in it. These bacteria make food for plants. However, if the pores of the soil are continually filled with water so air can not get through them, or if the soil does not contain organic matter such as decayed leaves or stable manure, etc., the bacteria can not exist and consequently can not prepare plant food. Now in order to produce a maximum yield of corn, it is necessary to have a soil well filled with humus or organic matter, and well drained.

Good corn soil.—The nature of the soil in which corn is to be planted has a great deal to do with the yield of ears. From the nature of its root system, corn is a plant that must have a deep,

¹ The germ is on the side of the kernel toward the tip of the ear, so be careful not to injure it when removing the kernels.

rather fertile loam, well filled with organic matter. As a rule bottom lands are best suited for corn growth, though very good crops have been produced on upland soil when such soil has received the proper fertilizers and has been well prepared. In the Philippines where we have a long rainy season a large amount of plant food in our soils is leached out each year, and unless manure or other fertilizer is added, we will get a poor yield of corn. It is a bad custom to plant corn on land low in plant food, and since our farmers as a general thing do not have enough money to buy commercial or chemical fertilizers, we must improve the fertility of our soil by adding stable manure or plant and plow under some crop like mungo or cowpeas. These two crops have small microorganisms on their roots which have the power of taking plant food from the air and of storing it in the soil for plant use. When these plants die, their roots with the plant food in them remain in the soil and make food for other plants that are later planted in the same soil.

Some soils not good for corn.—Certain plants adapt themselves to their environments, but this is not so with corn. A soil low in plant food may produce a small corn stalk, but no grain. On some farms there are large areas planted in corn, many portions of which will not produce a crop. These portions may be clayey spots, or swampy or undrained areas, or ground adjacent to timber. It is too great a waste of time and labor to cultivate such places. The clayey spots should be fertilized, the swampy areas drained, and the corn planted farther away from the timber if a good crop is to be raised.

In a great many cases a rearranging of fields will increase the yield of corn on many farms. This will make them more uniform as regards moisture and soil fertility. Very often there are wet places in fields when the remaining portions are dry enough to be cultivated, and when such wet places are plowed the mechanical condition of the soil is injured.

Preparation of the seedbed.—Land for corn should be plowed at least 20 centimeters deep with an implement that will not bring the subsoil to the surface. All trash and other waste material should be well covered by the breaking plow. A harrow should immediately follow the plow to pulverize all lumps of earth and to leave the soil smooth and level. Straight rows should be run at right angles to the slope of the field. These rows should be 1 meter apart and 7 centimeters deep. Seed corn from tested ears should be planted in hills 30 centimeters apart with one kernel in each hill.

CULTIVATION OF CORN.

Time to plant.—Where two crops of corn are grown each year, the first should be planted during May and June and the second in October and November. The first crop will be ready for harvest from the latter part of August to the first of October; the second, from February to March. In a great many localities in the Islands corn may be seen in almost any stage from planting to harvest at any time of the year.

Depth to plant.—The quality of the soil and the moisture content are very important things to consider when planting seed. If the soil is a stiff or heavy clay containing plenty of moisture at planting time, 3 centimeters is sufficiently deep; but if it is a light, open dry soil, 7 or 10 centimeters is better. Seven centimeters is a good average. If corn is planted deeper than 10 centimeters much of the food supply stored in the seed will be consumed before the young plant can reach the surface and expand its leaves. Planting the seed deeply does not send the roots deep into the soil.

Cultivation.—In studying the growth of corn, the roots should receive considerable attention because it is necessary to understand them in order to intelligently cultivate the growing crop. There is no taproot to corn, though the lateral roots are sometimes longer than the plant is tall. Roots from plants 30 centimeters high may lap across the rows, and unless shallow cultivation is practiced the crop will be ruined. Experiments have shown that while corn sends many of its roots 90 to 120 centimeters deep, the plant places the great body of its feeding roots from 7 to 25 centimeters below the surface where the soil is made loose enough by plowing to permit it. The roots send out in every direction an infinite number of hairlike growths, which absorb moisture and food. Corn is a surface feeder.

The surface of a corn field should be smooth and level and the cultivation should be frequent and shallow. Cultivate the ground deeply before planting, but afterwards the cultivation should be as shallow as possible.

Cultivation should begin immediately after the first rain that follows planting. There is no better implement for this work than a light smoothing harrow with slender teeth pointing backward. The corn should be hoed and thinned to the proper number of stalks when it is from 10 to 15 centimeters high, as it will then be past danger from bud worms, cutworms and other insects which often attack the young plants soon after they appear, but which seldom do any injury later in the season. At

the same time any weeds which may be growing in the rows between the stalks should be cut out. After the corn becomes too large for using a harrow, the best work can be done with a light side harrow, or with a cultivator having from five to seven teeth and running not more than 5 centimeters deep. The cultivation should be sufficiently frequent to keep down all weeds and to break the surface crust after every rain. In time of drought the cultivation should be as frequent as possible.

CARE OF SEED CORN.

After we have selected, tested, planted, cultivated and harvested our corn crop, the next thing to do is to preserve it until ready to be sold or planted again. It is very important that all corn which is to be used for seed should be preserved in the best manner possible. Though seed corn may be thoroughly dried, it will absorb moisture again when it comes in contact

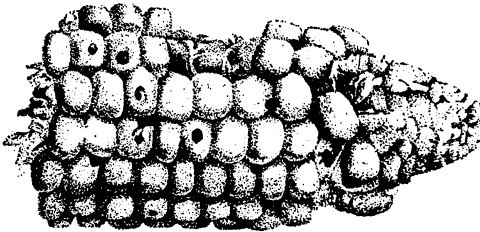


FIG. 5.—Corn Attacked by Weevils.

with a damp atmosphere. When first harvested, seed corn very often contains from 20 to 30 per cent of moisture, and unless it is well dried it may be ruined in a single day through heating.

At harvest time, when the ears of corn are ripe they should be taken from the stalks with the husks on and should be placed in a dry, well ventilated place where the ears can be spread out. The seed ears should be spread in the sun during the middle of the day for several days until they are thoroughly dry. Then the ears should be tied by the husks into bundles of ten or twelve. Be careful, however, not to take all of the husk off. These bundles should now be hung on the rafters in the ceiling of the planters' home where they will not get damp.

Weevils.—In the Philippines, as in all hot countries, stored grain is always damaged by weevils. These weevils are small insects having snouts which they use to bore into the kernel of corn for the starch and germ contained therein. Therefore in storing corn, it is very important that farmers guard against

the attack of weevils. These insects can be held in check by having the husks fit tightly over the ears and by planting varieties with hard kernels (flint corn); the only effective and

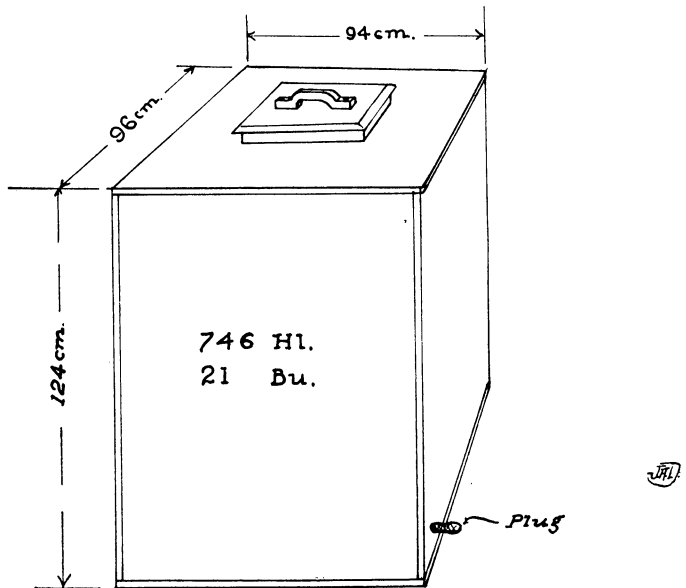
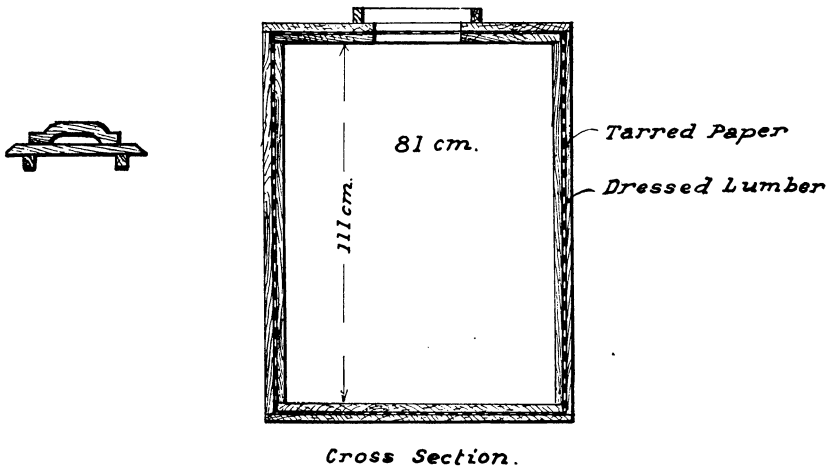


FIG. 6.—A Quarantine Bin for Bisulphide of Carbon Fumigation

simple method of eradicating them in stored corn, however, is by using carbon bisulphide, a colorless liquid with a strong, disagreeable odor which soon passes away. It evaporates very quickly, is highly inflammable, but is a powerful poison.

How to apply carbon bisulphide.—If the weevils attack your seed corn, get a deep box or tight barrel. Place the seed corn in this; bore a hole in the side near the bottom and plug this during fumigation, after which the plug should be removed for the gas to escape; put 31 grams of carbon bisulphide in a saucer or on a piece of cotton; place this on top of the corn and then cover the top of the box or barrel with a piece of burlap or canvas, leaving this covering on for six hours.

The carbon bisulphide rapidly volatilizes or turns to gas, and being heavier than air, it descends and permeates the mass of corn, killing all insects or other vermin present.

Carbon bisulphide retails in Manila for ₱2.86 a kilo.

Caution.—The vapor of carbon bisulphide is deadly to all animal life if inhaled in sufficient quantity, but there is no danger in inhaling a small amount. The vapor is very inflammable, and a lighted cigarette or cigar should not be brought in contact with it.

CORN AS FOOD FOR MAN.

There are a great many people in these Islands who think that corn is not "fit" for human consumption, but think it is good only for feeding horses, carabaos and pigs. This is a great mistake. Corn has been used for human food for many centuries. It was one of the chief articles of diet used by the American Indian, and was transmitted by him to the early immigrants who settled America. It has long been grown by the Arabs of northern and the Kafirs of southern Africa, and is a staple crop throughout most regions of the African continent, as well as in southern and central Asia, China and Australia. After the potato famine in 1847, an effort was made to introduce corn into Ireland and since that time a considerable amount has been grown and used for food in that country. To-day corn forms the main food for two-thirds of the rural population of Italy, Mexico, Central and South America and the West Indies and is a very valuable food crop in the Southern States of America.

In speaking of the food value of a certain product, we mean the ratio existing between the digestible protein and the carbohydrates and fats it contains. This is called the "nutritive ratio," and is obtained in the following manner: The amount of digestible fat or oil is multiplied by 2.25, because the fat or oil is considered as having this heat value compared with the carbohydrates. The product obtained is added to the total quantity of digestible carbohydrates.

To get the nutritive ratio of corn meal, the digestible nutrients in which, as given in the following table, are, protein 9.0, carbohydrates 61.2, and fat or oil 6.2, we proceed as follows:

Fat, 6.2 × meat equivalent, 2.25	13.95
Fat, 13.95 + carbohydrates, 61.2	75.15
Fat, 75.15 ÷ protein, 9.0	8.33

The nutritive ratio is 1: 8.33.

Nutrient value.

Product.	Protein.	Carbohy- drates.	Fat or oil.	Authority.
Corn, germ meal---	9.0	61.2	6.2	Henry, United States Farmers' Bul- letin No. 417. Do.
Cleaned rice-----	8.00	79.0	0.3	
Wheat flour-----	10.8	74.8	1.1	

Therefore in expressing the nutritive ratio of corn meal thus, 1:8.33, it is meant that for each part of digestible protein in corn meal there are 8.33 parts of digestible carbohydrates and fat equivalent. In like manner the nutritive ratio for cleaned rice is found to be 1:9.96.

From this it will be seen that both corn meal and rice are carbonaceous foods, or foods that have a very much larger percentage of starch than protein. Now a food that contains both carbohydrates and protein in sufficient amounts, or having a nutritive ratio of 1:5 or 1:6, is called a balanced ration. Then neither corn nor rice are balanced rations. They are "medium" and to give the best results, a food having a large amount of digestible protein, such as lean meat, eggs or beans, should be eaten with them. Carbonaceous foods are fattening, while a protein food makes muscle and lean meat. They are concentrated foods and are highly nutritious. If the market value and the amount of nutrition in corn are considered, it is by far the cheapest food offered to mankind. Like rice, corn is a carbonaceous food, but unlike rice, it is rich in fat or oil and contains more protein. Compared with wheat, corn has somewhat less carbohydrates and protein, but more oil. The germ of the corn grain contains the oil, while the starch is found around and above the embryo.

As an article of diet, corn should be very popular in the Islands because it comes nearer being a balanced ration than rice and, too, corn can be eaten while the ears are young as well as when mature, while rice, it is said, should be at least three months harvested before it is used for food.

AN ATTEMPT TO IMPROVE THE QUALITY OF ABACA.

By M. M. SALEEBY, *Chief, Fiber Division.*

The present condition of the abacá industry is very much complicated, and its improvement must necessarily require the coöperation of the three parties concerned—namely, the producers, the buyers, and the Government. Such coöperation is absolutely necessary, for at the present time all the phases of the industry are sorely neglected and the planters are in a condition a little better than one of utter despair. This is especially the case in Albay Province, where the problem is indeed so complicated as to require for its solution means and efforts beyond the reach and power of any single one of the parties concerned.

Upon the Government devolves the duty of teaching the producers the best methods relative to the cultivation of the plant and the best means for extracting and handling the fiber, thus enabling them to obtain a maximum yield both in the quantity and the value of the product. The chief difficulty encountered by the Government in carrying on its own work with the producers has been not so much the want of confidence by the latter in the methods suggested, as in their inability to practise them, owing to the lack of the necessary capital. This, of course, was in turn due to the inability of the producers to obtain just and reasonable prices commensurate with the grades they produced. The local buyers did not sufficiently discriminate in their prices between the high and the low grades of the fiber, and the general production of inferior grades followed as a natural consequence. Such is the present condition of the abacá industry in many of the principal abacá provinces, such as Albay, Camarines, Sorsogon, Leyte, and others.

It is plain, therefore, that the first step in the solution of the abacá problem is some kind of understanding or coöperation, first, among the intelligent class of producers in any province, and second, between them and the local buyers. The solution of this question will considerably facilitate the solution of the other problems, in which the Government is more directly concerned.

The above explains why this Bureau is watching with a great deal of interest the commendable efforts which the provincial governor of Albay is putting forth to bring about an understanding between the producers and buyers of abacá in his province, which is essential for the ultimate improvement in the general conditions of the abacá industry. It is reported that at his call two conventions were held at Ligao and Tabaco, in which both the producers and local buyers discussed at length the various measures that should be taken to restore the industry to its former condition of prosperity. It is also reported, though no details have as yet been received, that the results were very promising and that an understanding for the encouragement of the production of the higher grades of the fiber was arrived at. The efforts of the provincial governor, even though it will be sometime before they are completely materialized, constitute the best and most commendable service that a governor can render to his province, and we hope that the governors of the rest of the principal abacá provinces will take a similar interest and endeavor to improve the status of the industry in their own provinces.

Albay is the principal abacá province in the Philippines, and if the producers and buyers of the product are really actuated by a common desire to improve the condition of the abacá industry, their concerted action will have the influence and force of a law. The benefits to the province in general from such an understanding between the producers and the buyers will certainly justify any efforts that may have been put forth to bring about such an understanding. The exports of abacá from Albay during the calendar year 1911 were approximately 55,000 tons which, valued at ₱144 per ton, represented a revenue of about 8 million pesos. If the fiber had been more carefully cleaned and taken care of, the grade of the fiber should have averaged, at least, good current instead of superior seconds or fair current U. K., as is the general average there. Cleaning the fiber so as to average good current or over will necessarily reduce the quantity about 20 per cent, but will increase the value by 75 per cent or more. Thus if the quantity produced during the year 1911 had been so prepared as to average good current only, it would have amounted to 44,000 tons which, valued at ₱260 per ton, would have represented a revenue of about ₱11,500,000, or a net gain of ₱3,500,000. This increase, properly and judiciously spent, would go a long way towards improving the condition of the plantations and strengthening the economic standing of the producers in general.

THE SILO.

By CHAS. M. CONNER, *Chief, Division of Agronomy.*

The Bureau of Agriculture has just completed and filled a circular cement silo at the Alabang stock farm, which is the first cement silo in the Far East. It is 5 meters in diameter and $8\frac{1}{2}$ meters high and has a capacity of 100 tons.

While silos are not as essential in feeding dairy cattle in this climate as they are in those sections having long winters, yet there are times during the dry season when there is a scarcity of green fodder. It also happens that we can grow sorghum and corn much cheaper during certain seasons than during others, and this sorghum or corn may be preserved in the silo and fed during the dry season, at a cost much less than that at which green fodder can be purchased during such times of scarcity.

A silo is merely a building having air-tight walls for the purpose of preserving green fodder by the heat resulting from fermentation. Green fodder thus preserved is called ensilage or silage. The same result may be obtained by digging a pit in the ground, but in a country like this where there is an excessive rainfall, such a practice is not advisable.

In India a fairly successful silo has been built of split bamboo woven together in the form of a large basket about $2\frac{1}{2}$ meters in diameter with perpendicular sides 5 meters high, then made air-tight by plastering with mud. A good cheap silo, any size desired, may be constructed by nailing expanded metal to upright pieces of two by four and plastering this with cement.

The cylindrical form of the silo is now most used. Aside from the fact that this form has less surface exposed than a rectangular structure of the same capacity, it can be built with the least amount of lumber. A high and narrow silo is preferable to one low and broad, because in the high silo the weight of the upper part of the column helps to drive the air out from the lower part. In adjusting the size of the silo to the

herd, the diameter should be increased or decreased and not the height. The usual plan is to have the silo extend about 8 or 10 meters above the ground and $1\frac{1}{2}$ to 2 meters below the surface, depending upon the slope of the ground and the drainage.

The only reason for limiting the height to 10 meters is the fact that blowers and carriers for elevating the material over the top of the silo do not work well for greater heights. The silo may have any diameter from 2 to 8 meters. Cement should be used for making the foundation in order to prevent surface water from entering the pit and spoiling the silage.

There are two absolute essentials to the success of the silo: Its walls must be perpendicular and smooth because the loose material will settle as much as 2 meters during the first two or three days and if the walls are not perpendicular and smooth there will be spaces left between the material and the walls which will allow the air to enter and spoil the silage; the walls must be air-tight for the same reason. Close-fitting doors 50 by 60 centimeters should be placed one above the other, 2 meters apart, for the purpose of taking out the silage. The silo is filled from the top but the doors should be left out as long as possible in order to give ventilation while the men are spreading and packing the material.

The cost of the silo will depend upon the kind constructed. A one-hundred-ton silo may be constructed of wood and plastered at a cost of three pesos for each ton of capacity. One of reinforced cement, having walls 10 centimeters thick will cost about ten pesos per ton of capacity. For a smaller silo the cost increases slightly, and decreases for one of larger capacity.

In the Tropics silage will spoil if exposed to the air more than twenty-four hours; it is therefore essential that the diameter of the silo be governed by the number of cattle to be fed. A layer at least 5 centimeters in depth should be taken off each day so that a perfectly fresh surface will be exposed. A silo 5 by $8\frac{1}{2}$ meters will hold sufficient feed to furnish 15 kilos per day per animal (one day's ration) to fifty animals for one hundred and thirty-five days. One cubic meter will weigh approximately 650 kilos.

Green feed preserved in the silo is not bettered in any way except that some materials may be improved in palatability. The gain is in being able to secure the feed when abundant and cheap, and keep it until there is a scarcity.

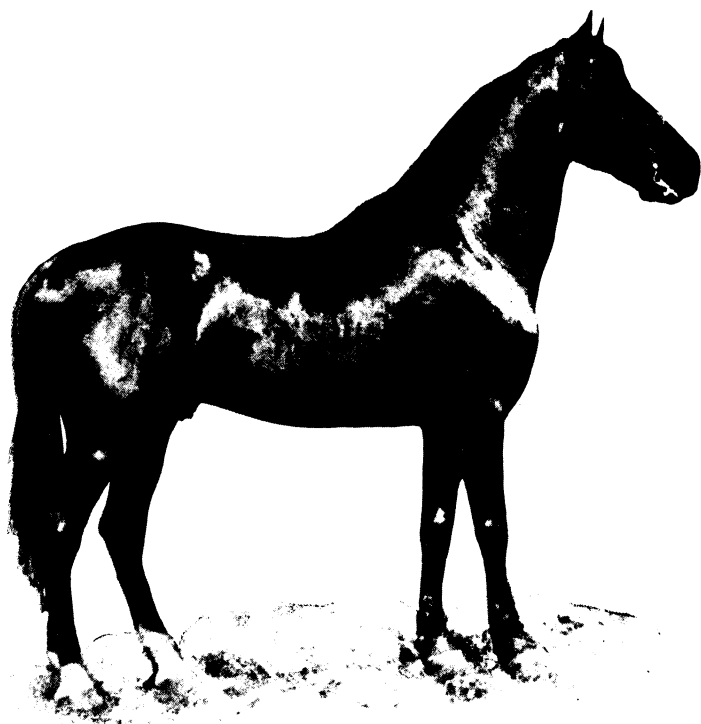


PLATE II.—MORGAN STALLION "DUKE OF ALBANY," BUREAU OF AGRICULTURE
BREEDING STATION, VIRAC, CATANDUANES.

Any green fodder that is nutritious may be used for filling the silo provided it does not have a hollow stem like rice. The hollow stem will retain so much air that it will cause the material to spoil.

If such crops as mungos, cow peas, velvet beans or beggar-weed can be mixed with the corn or sorghum, a nearly balanced ration for dairy cattle or work animals will result.

Sugar-cane tops would also make good silage provided something less sweet were mixed with them. The fermentation which goes on results in the formation of more or less acid, depending upon the materials used. Sorghum or sugar cane alone would make rather sour silage.

The corn, sorghum, or whatever material is used for filling the silo, should be cut at the stage of growth when it contains the greatest amount of digestible matter; for example, corn should be cut after it has passed out of the milk stage, and sorghum should be cut as soon as the heads turn dark or show signs of ripening. Just here may be mentioned another of the advantages of the silo: much more digestible matter may be obtained from a hectare of corn or sorghum by cutting and preserving in the silo than by cutting and feeding from the field. If handled in the latter way much of it must, of necessity, be cut too young when it is watery and really not fit for feeding, or it must be allowed to stand until it is overripe and has become dry and woody.

If it should happen that a drought has caused the crop to dry up and have many dry or dead leaves on the stems, the material should be dampened as it is put into the silo in order to prevent dry rot. Just how much water to use must be determined by practice. Rain need not stop the filling process as an excess of water would do little damage as compared with not enough. It is essential that the material be well packed next to the wall as the silo is being filled. This may be done by a man walking around keeping one foot close to the wall.

In order to fill a silo properly it is necessary to have a cutter with a blower attached for the purpose of elevating the material into the silo. The corn, or whatever else is being used, should be cut into pieces about 2 centimeters in length.

A cutter for a silo 5 by 8 meters would cost about ₱200 and would require about an eight-horsepower engine to run.

The cost of filling will vary with the distance the material has to be hauled and the kind of the material used. The cost of filling the one at Alabang with sorghum was ₱1.87 per ton

for cutting, hauling, and putting through the cutter into the silo. The average haul was 1 kilometer.

When once the filling has been started, it is necessary to continue until finished. A stop of one day may be made without danger of loss but in case it is necessary to stop for several days or a week, the decayed stuff should be thrown off the top before any new material is put in. When the silo has been finally filled it should be well packed on the top and wet down so as to induce the surface to start decaying. This, in a measure, seals up the top. Never allow this cover to be broken until you are ready to commence feeding.

Silage alone may be fed to animals doing no work, but animals at hard work should have a grain ration in addition. As it does not differ in composition in any essential points from the material before it was put in the silo the animals may be given all they will eat of it.

Cattle do not eat silage readily at the first feeding, but after a few trials they become very fond of it. It is for this reason that the silo is most used by dairymen where the cows are kept for years. It would not be profitable to men who feed beef cattle for a few weeks only.

SECOND ANNUAL CATANDUANES LIVE-STOCK AND AGRICULTURAL FAIR.

By C. W. EDWARDS, *Husbandman*.

One of the most convincing evidences of the interest and coöperation that the people of the Islands of Catanduanes are according the general work of improvement of animal husbandry and agricultural conditions, which is being carried on in the Island by the Bureau of Agriculture, is their annual live-stock and agricultural exposition, inaugurated last year. The second exhibit was held at Virac, July 4 to 7 inclusive, and the many entries presented, large number of people in attendance and general enthusiasm, gave strong indication of the success and permanency of this institution. Fairs of this nature are very potent factors in the great work of upbuilding the general agricultural and live-stock conditions of a country and in this movement Catanduanes has set an example which may well be followed by other provinces. In this connection a brief outline of the original plan of organization may be of interest:

A central committee of five members—the initial organization having been appointed by the Lieutenant-Governor—is given charge of the work of preparing and conducting the exhibit for the ensuing year, and at the conclusion of the event they in turn appoint their successors for the year following. It is the duty of these members to appoint representatives in each municipality who shall choose subcommittees in each barrio of their respective districts. The main duties of the members of the subcommittee are to keep the people informed as to the general plans and progress of the exhibit, to create enthusiasm and aid in securing entries. A queen of the exposition and ladies in waiting are elected by public ballot. Votes are sold for various candidates at one centavo each and the proceeds thus obtained are utilized in the defraying of incidental expenses and in paying cash premiums for the various classes entered at the exhibit. The initial work of organization entailed the securing of a suit-

able site for the exposition grounds, clearing of the land, erection of necessary buildings, etc. In this work various municipalities and barrios donated materials while others furnished laborers. The site was given by the town of Virac.

The same general plans as outlined above were followed in the work of the 1912 exposition.

A number of Manila merchants and firms added a great deal to the interest and success of this year's exposition by very generously granting a number of premiums. The following is a list of these donators with the respective contributions:

Pickett Harness Co., one fancy carromata harness, one MacClellan saddle blanket and bridle.

M. A. Clark Co., 50 kilos candy, 68 cans coffee.

Germinal Cigar and Cigarette Factory, 420 cigars, 200 packages of cigarettes.

The San Francisco, one handbag.

American Hardware and Plumbing Co., one patent wire gate.

Squires-Bingham Co., one mirror.

"La Badenia," Inc., Cigar Factory, cigars and cigarettes.

Smith, Bell & Co., Ltd., ₱25 in cash.

The members of the central committee were as follows: Eustaquio Joson, president; Valentin Francisco, treasurer; Alipio Arcilla, secretary.

Municipal representatives chosen by the central committee were: Eusebio Reyes, Virac; Pedro Chaves, Bato; Braulio Tafala, Calolbon; José de Vera, Pandan; Aurelio Arcilla, Baras.

Miss María de Vera of Pandan was the popular choice for queen and the Misses Carmen Arcilla of Virac and María Abalda of Calolbon were chosen as ladies in waiting.

The official opening occurred on the morning of July 4. The beautifully decorated carriage of the queen and her ladies, and their mounted escort, headed the civic parade which formed on the municipal plaza and marched to the exposition grounds. The Independence Day oration was delivered by Assemblyman Silvino Brimbuela, which was followed by an address dealing with the exposition, its importance to the Island, its aims, future, etc., by the newly elect third member of the provincial board, Sr. Timoteo Alcalá.

The various classes of animals and agricultural products were very well represented. There was an especially large number of horses presented, in several classes the entries numbering as high as thirty-five animals. The most interesting and significant exhibit in this department was the mares with mestizo

colts the get of the Bureau sires now located at the breeding stations on the Island. This class presented to the people concrete examples of the beneficial results obtained from crossing the native stock with animals of superior breeding and such convincing demonstrations can only result in a more willing and earnest coöperation in the work of upgrading the native live stock.

The exposition proper terminated July 6 and on the following morning a happy conclusion of this successful exhibit was the gathering of the people on the town plaza to listen an address by the queen and to witness the distribution of the premiums.

The officials and people in general of Catanduanes deserve much credit for the success attained thus far in this line of endeavor, as events of this character have a deeper significance than simply an exhibition of the country's products. They are indications of a progressive movement resulting in permanent general improvement, better crops, better live stock, more and better food and clothing, higher education, and a higher standard of living.

CURRENT NOTES ¹—OCTOBER.

THE CORN CROP. .

The corn crop which was harvested the past month was perhaps the largest that has been harvested for a corresponding period in many years. The reason for this, of course, was the short rice crop.

In passing through the fields one is struck with the closeness of planting and the lack of cultivation. The yield could have been made much larger if the rows had been given sufficient width and the crop properly cultivated. Most planters seem to think that corn should be planted like rice, i. e., thick enough to keep down the weeds. Corn so planted will give a heavy yield of fodder but little grain. The maximum amount of grain is produced when the individual plants are given plenty of room. The rows should be not less than 75 centimeters apart and the stalks 25 centimeters apart in the row. The crop should be cultivated about five times during the season.

It is possible to grow three crops of corn each year but two of these will be light. The heaviest yield can be obtained by planting in February.

The following yields were obtained with Mexican June planted at Singalong:

Planted, June 23; harvested, September 30; yield, 1,300 kilos per hectare.

Planted, October 15; harvested January 23; yield, 1,858 kilos per hectare.

Planted, February 3; harvested May 31; yield, 2,840 kilos per hectare.

It should be mentioned here that irrigation water ought to be available for the dry season. (*C. M. Conner.*)

ANOTHER NEW BRANCH OF ANIMAL INDUSTRY.

Notwithstanding the vast increase in imports of alligator skins in New York during the past few years, prices still con-

¹ Original notes prepared by various members of the Bureau of Agriculture.

tinue high. A good skin from 2 meters to 3 meters in length is now worth about ₧3 delivered in New York. One firm in Newark, New Jersey, controls the bulk of the trade which now amounts to probably some 50,000 to 75,000 skins per year. These skins come from Colombia and Venezuela where they are collected by native Indians who slaughter the animals by crude methods. Rifles are seldom used, the hunters finding it much cheaper to spear the reptiles in shallow creeks and ponds in the dry season; after the spears have weakened the alligators, they are hauled out upon the bank and beheaded with a long-handled (sic) ax. Very probably traps or inclosures made of wire-fencing material could be used to corral large numbers of the reptiles and thus cheapen the cost of collection. In fact, it is said that nets made of stout wire have been used successfully in catching the smaller whales.

It is a question, however, whether this industry would ever pay on a large scale in the Philippines. There is no doubt but that certain lakes, such as Lake Nauhan in Mindoro, and some of the rivers and lakes in Mindanao, would furnish plenty of business for the "caiman" or "buwaya" hunter.

In this connection it must be remembered that there are several kinds of crocodiles and alligators; those which have the thick osseous deposits in the skin are not of much value to the tanner; a pliable, "green-salted" hide with no bone-plates makes the best article. (*O. W. Barrett.*)

HORSES IN DENMARK.

Though comprising only about one-eighth the area of the Philippine Archipelago, the little country of Denmark boasts of possessing 550,000 horses, whereas in the vast area of the Philippine Archipelago less than 250,000 horses exist. By the way, the daily ration of the huge Jutland horse of Denmark is about 7 kilos of oats, $2\frac{1}{2}$ kilos of maize, 1 kilo of molasses, 3 kilos of hay and $1\frac{1}{2}$ kilos of straw; this allowance would last the average Philippine pony nearly one week. (*O. W. Barrett.*)

SOYA SOAP.

The vast area planted with "Manchurian beans" in north-eastern China and the contiguous portion of Siberia may in the near future be greater still. A new field for bean oil has been found and the new factories in Mukden and Dalny are now turning out very large amounts of both laundry and toilet soaps.

It is understood that the Lever Bros. Ltd., of Port Sunlight, England, will also establish a monster soap factory at Kobe; the only drawback thus far is the lack of alkali in Japan and northern China. According to the Bureau of Manufactures of the United States Department of Commerce and Labor, the United States uses considerably over ₱5,000,000 worth of bean oil annually.

Soya oil affects the price of copra. Soya soap relieves the overproduction tendency of bean oil and thus becomes a long-distance enemy of the Philippine coconut, although it directly assists in a degree in keeping up the price of soya oil. (*O. W. Barrett.*)

AMERICA'S HEAVY SEED IMPORTATIONS.

Although the United States produces most of its own seeds, both vegetable and grain, there are also in evidence very costly importations from abroad. For instance, it takes over 1,000 tons of caraway seed, over 500 tons of anise, and over 500 tons of coriander for flavoring various beverages, confections, etc. Most of these seeds can be produced more cheaply in Europe than in the United States. In addition to the great quantity of home-grown sugar-beet seed, some 5,500 tons are imported from Europe. It is a matter for considerable doubt whether all the canary birds and their caged cousins in the United States can consume the 3,000 tons of canary seed brought over from Europe every year—or whether a part of this huge pile finds its way into other channels. (*O. W. Barrett.*)

FORMOSAN RAILWAYS.

A railway which will out-Baguio our line to the summer capital is being constructed from Kagi to near the top of Mount Ari, 2,300 meters above sea level. This short road of only 65 kilometers is well provided with 70 bridges and 73 tunnels. The scenery from this new line, it is claimed, will rival that of any other road in the Orient. The railway, however, is not for the pleasure of the tourist, although the views looking down upon the clouds and tropical jungles and gorges of the interior will be exceedingly fine; this road is really a timber-hauling concern. Not only the red cypress and cedar-like timber trees, some of which are two thousand years old with a circumference of some 20 meters at the base, but also oaks and other high-grade woods will be brought down by American locomotives to a genuine Milwaukee sawmill at Kagi. (*O. W. Barrett.*)

HAWAIIAN COFFEE.

Hawaii has been struggling bravely with her coffee proposition for some time and now it appears a trial order has been placed by the Commissary-General of the War Department at Washington for some 17 tons of Hawaiian coffee for use in the United States Army here in the Philippines. (*O. W. Barrett.*)

LIVE-STOCK INDUSTRY OF ERITREA.

Italy now needs a better meat supply and, with this end in view, is endeavoring to develop the cattle, sheep, and goat production of the Italian colony on the Red Sea. The cattle men of the Philippines will be interested to learn that the Italian Government has instituted a "tax for vaccination of live stock" in Eritrea and an expert from the Italian Vaccine Institute is now on the ground enforcing the new regulations. If all goes well, the fertile plains and valleys of the hinterland of Eritrea will soon be producing a large proportion of the over-sea meat supply of Italy.

This colony may in the near future become famous for its excellent horses, of which there are now only some thirty thousand head. A superior race of dromedaries is also raised in that country; there are some 50,000 of these animals according to the last census. The three hundred thousand head of meat cattle will be rapidly increased.

Though in size only a very small colony as compared with Benadir, or Italian Somaliland, Eritrea has a population of about half a million—probably more than that of all Benadir, which exceeds the Philippines in area. (*O. W. Barrett.*)

A NEW USE FOR CHICLE.

Some 3,000 tons of chicle are annually imported into the United States for chewing gum. Practically all of the supply comes from Mexico and Central America. In Peru, however, where a fair amount of this gum can be produced, a sort of waterproof varnish is prepared for treating the so-called Panamá hats to give them the proper creamy shade and brilliancy.

Hence the Philippine chico has another use ahead of it, even if it never helps furnish the 10-tons-per-day gum supply. (*O. W. Barrett.*)

RUBBER AND DROUGHT.

The prolonged drought throughout the Far East has undoubtedly done a very large amount of damage to the rubber plantations especially to those not yet of tapable age. While the trees

are struggling against death from thirst, it is manifestly unwise for planters to reduce their vitality still further by tapping them; and the young trees whose root systems are still close to the sunbaked surface of the soil must needs become pretty badly "set back" or stunted—an effect which may persist for several years.

This drought has surprised even the old residents not only of East Africa but away around into Tropical America. It is stated that the Orinoco has been the lowest on record during the past season; it is interesting to note, however, in this connection that the shortage of water in that river is partly due to a larger channel which the famous "connecting link" river, the Cassiquiare, has made for itself from the upper portion of the Orinoco backward into the Rio Negro, a tributary of the Amazon.

This difficulty of water transportation of the Orinoco has affected the production of balatá; since nearly all of the world's supply of this article comes from the Orinoco Basin, the price of Mindanao guttapercha should feel a slight increase.

Over in the Federated Malay States the drought has affected rubber so much more than coconuts that a rather rash comment has inadvertently come to notice, to the effect that "coconuts are better than rubber these days." (O. W. Barrett.)

ARTIFICIAL SILK.

Silk has another new rival besides "vegetable casein," spun wood, and cotton silk—a new kind of *spun glass*. The glass fibers, while of course liable to wear out in time, are proof against mildew, acids, etc. The new glass fiber, which is about one-eighteenth the diameter of a hair," gives a perfectly pliable, brilliant, and strong fiber which resembles silk in appearance; it can, of course, be colored to "suit the taste."

This new glass silk costs only 50 to 60 centavos per kilo and may become a serious rival of caterpillar silk—if we must now be so specific in speaking of the real article.

About 32,000 tons of the genuine article are now produced annually. By the way, how many million tons of the humble and seldom-mentioned mulberry-leaf does this represent? (O. W. Barrett.)

A NEW RIVAL OF KAPOK.

"Crin végétal" is a comparatively new vegetable fiber made from the leaves of North African palmettos. It is used principally in stuffing furniture, mattresses, etc., and while very much coarser than kapok, it is obtainable from the natives, who

work at gathering this product during the slack season, at ₱0.80 per hundred kilos. The middleman, of course, makes a good profit, but even at the Hamburg price of ₱30 per ton, kapok may find a serious rival. (*O. W. Barrett.*)

SOYA BEANS IN ARGENTINA.

The soya has just found a new field in what will probably be one of the best agricultural regions for the culture of that famous legume in the whole world. Instead of flax, which has heretofore been grown for linseed in rotation with wheat and maiz, the soya will now be used in Argentina both for its own oil and as a soil restorer, thus increasing the fertility of the fields.

While the percentage of oil in ordinary soya runs from 16 to 20 per cent, some of the new varieties which will be planted in the alluvial plains of the Plate River will contain up to 23 per cent. (*O. W. Barrett.*)

TRANSPLANTING EARLY RICE.

In transplanting early rice the people near Calauan, Laguna Province, save from twenty to twenty-five days, by sowing the seed rice on banana leaves in the following manner: the seedbed is prepared in the usual way by puddling the ground thoroughly, then laying the banana leaves over the surface and sinking them until just enough mud runs in upon the leaves to cover the seed which is to be planted. The seed of some early variety is soaked for thirty-six hours in water in order to hasten the sprouting. The seed is then spread over the banana leaves about 1 centimeter deep. In twelve or fifteen days, the young plants are about 8 or 10 centimeters high and have formed a thick mat over the banana leaves. As the young plants cannot take deep root on account of the banana leaves, the plants may be easily separated without breaking the tender roots. Rice may be transplanted in this way at twelve or fifteen days of age, whereas if planted in the regular way the plants must be thirty or forty days old or the tender roots will be broken off in pulling the plants from the seedbed and many of the plants will not survive when transplanted to the field, resulting in an imperfect stand. (*C. M. Conner.*)

THE WORLD'S POTASH HUNGER.

Germany has heretofore held the purse strings, so to speak, of the world's supply of that necessary plant-food, potash. The profits from the "kali" mines in that country have been enormous; the business has amounted to almost absolute monopoly.

Realizing, however, that there must be a limit in time to the supply from those mines, the Ministry of Finance of Baden has been making explorations for new sources of this valuable fertilizer with the result that a new deposit some 4 meters in thickness has been discovered, though at the rather inconvenient depth of over 700 meters.

The United States Department of Agriculture some time ago made a special appropriation for the search for new sources of potash for that country. While several rather limited deposits of potash minerals have been located in the Western States, great interest is now attaching to the discovery of a method for obtaining potash direct from seaweed. This substance has long been used in a more or less haphazard way for mulching in orchards near the seacoast and sometimes for its ash to be used as a direct fertilizer. It now seems that the matter will be taken up on a large scale and that potash factories will be erected at suitable locations along the Pacific Coast, with steam trawls for collecting the raw material.

The present price of sulphate of potash in Manila is about ₱150 per ton. (*O. W. Barrett.*)

LARGE COPRA DRYERS.

In the July, 1912, number of the REVIEW mention was made of a new type of apparatus for drying copra on a large scale. The idea, not to say invention, seems to have originated with Mr. Hamel Smith, the editor of *Tropical Life*, who has had considerable practical experience in the handling of tropical produce.

It seems that the new "drying-by-the-acre" method of Mr. Smith is receiving considerable attention in the Federated Malay States and it is probable that within a few years that country will take up generally this method for handling its copra.

The system is exceedingly simple and the whole matter is one which must win the favor of every firm or dealer who desires to improve the quality of the product. Theoretically a strong current of air will dry raw copra in proportion to the degree of heat and the speed of the air current—i. e., in from ten, say, to twenty-four hours. Mr. Smith's idea is to force strong currents of air into a comparatively large drying house containing several skeleton floors upon which the "meat" is spread. The air is, of course, heated over and around large furnaces using husks and shells as fuel. Since the temperature in such a drying house would be comparatively low, it ought to

meet with favor from the Ceylon producers who, it appears from articles in recent numbers of the *Tropical Agriculturist*, are becoming afraid of high temperatures in drying copra; they profess to believe that any temperature high enough to dry raw product in a few hours will "volatilize the oil" content of the raw material. By the way, there is, of course, a grain of sense in this fear; certain oils could be very quickly volatilized even without heat; but *coconut oil does not* belong in that class.

From the number of enquiries concerning copra dryers which have come to the notice of this Bureau recently, it is believed that the day when the middleman will be forced to recognize monetarily the difference between aromatically fragrant, perfectly dried, clean copra and the stinking half-rotten material (in which all sorts of fungi and bacteria are consuming the oil substance and thus greatly reducing the *real* value of the product) will come soon. (*O. W. Barrett.*)

CASSIA.

The world's supply of the old but still important spice-drug known as cassia, or Chinese cinnamon, comes to commerce both through Hongkong and Saigon. For some unknown reason there has been a great increase in shipments of the oil, as well as the "cassia-lignea" bark, during the past year. This oil and bark is used for the same purposes as Ceylon cinnamon, though being, of course, of inferior quality. Recent political disturbances and financial exigencies in China possibly account for the temporary fall in the export price.

The value of false cinnamon shipments, including oil, to the United States, is now considered to be about a million pesos per annum.

A few species of wild cinnamon trees occur in the forests of the Philippines. (*O. W. Barrett.*)

SHEA BUTTER AND OTHERS.

This commodity of the central section of the West Coast of Africa has been for many years a rather important item and although it does not at present enter largely into foreign commerce, it is probably only a question of a few years when the rapidly improving transportation conditions there will permit of this product's coming within reach of European markets. This vegetable tallow is prepared from the seeds of a large tree, *Butyrospermum parkii*. This tree and a cousin species, *Pentadesma butyracea*, which produces the kanya butter of Sierra

Leone, are represented in India by the famous Mahwa, *Bassia latifolia*; this produces vast quantities of dried flowers which are used in the making of alcoholic liquors; the oily seeds, too, yield a greenish, lard-like butter. The Shea butter of West Africa is used in cooking, as an illuminating oil, and as a sort of unguent panacea.

The Baro-Kano Railroad will open up an entirely new and large field for this product which was formerly confined largely to the waterways for transportation. The exports in Nigeria were only 2,000 tons in 1906, but in 1909 they had increased to 9,000 tons, and besides this amount 150 tons of the pure butter were exported in 1910; these figures will probably be trebled within one year.

The Shea tree, it should be remembered, does not exist in the area occupied by the West African Oil Palm—the great rival in that continent of the coconut.

By the way, coconut butter (*sensu lato*) is more important to-day than all the twelve or more other so-called vegetable “butters” combined.

And what *is* a butter? Strictly and entymologically speaking, butter is *ox cheese*: another dire example of the nerve-racking strain to which most of our good old English words have been put in the last few centuries. But, by the way again, isn't it about time that we had a word to indicate the kine species as an entity, one as unhampered by sex ideas as horse, pig, sheep, goat, etc.? “Ox” will not serve the purpose, at least not in America; “Bos” would answer nicely; in fact we have it already, but only cattlemen and zoölogists will use it. (O. W. Barrett.)

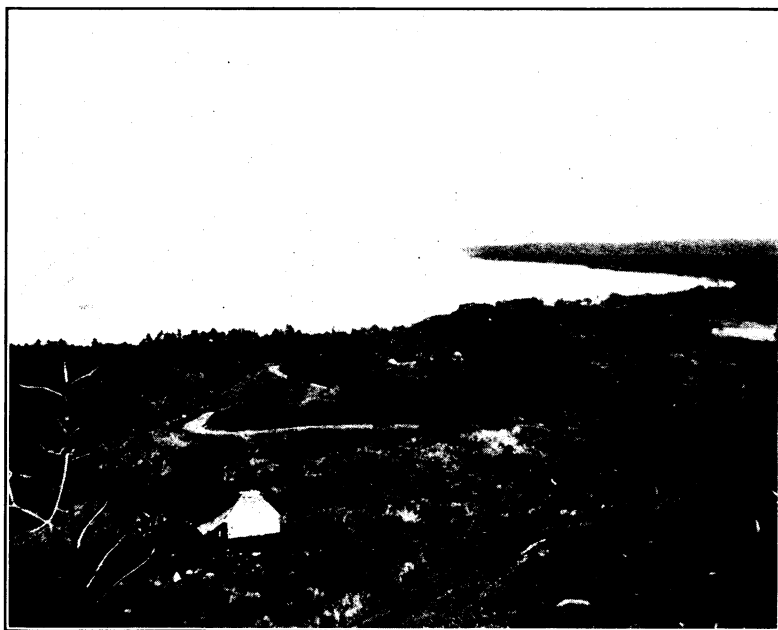
TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

JULY, 1912.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.		Tem- pera- ture.	Rain- fall.	Tem- pera- ture.	Rain- fall.	Aparri.		San Fernando.	
	Tem- pera- ture.	Rain- fall.	Tem- pera- ture.	Rain- fall.					Tem- pera- ture.	Rain- fall.	Tem- pera- ture.	Rain- fall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	30.1		28.4		28.4	1	29.5		28		28.6	5.8
2	28.5	1	27	3.3	26.2	1.9	29.2		28.7		29.2	33.8
3	27.6		27.2	1.6	26.1	30.2	29.4	36.1	28.6		27.2	18.8
4	27.5		26.9		26.3	4.6			29.6		28.8	2.8
5	29		27.7	7.6	26.7	1.3	29	20.8	29.4		28.2	21.6
6	29	.5	27.8		27.2		29	3.8	29.2		27.2	18
7	28.2	12.7	27.4	4.9	27.4	8.1	28.8	67.8	28.6		28.2	1
8	26.1	10.7	27.1	5.1	26.1	7.7	26.5		27.6	17.8	26.9	2
9	26.7	3.8	26.3	1.3	26.1	8.6	26.6	5.6	27		26.4	
10	26.9	4.3	27.1	.5	26.9	11.2	28.2		27.8		27.4	11.9
11	28.4		28.4		27.6		29.2		27.6	.8	27.5	5.1
12	29.2	4.3	28.5		27.7		29.2	12.7	27.3		27.4	
13	28.6	9.9	29	4.3	27.3	25.7	28.7		28.3		27.4	
14	26.8	17	27.9	14.3	26.2	8.9	27.6	4.1	27.8		25.4	
15	27.7	5.8	27.3	2.1	27.2	1	28.2	3.8	28.2		28.3	.3
16	25.8	11	26.6	5.8	26.7	.5	28.8	16.5	28.4		28.6	3.6
17	25.8	6.8	26.3	6.3	26.7		28.2	1.8	28.2		27.4	2.3
18	25.9	10.4	26.3	30.2	26.2	4.1	27.2	7.4	27.5		27.5	2.8
19	26.8	8.6	26.9	4.6	25.8	29.1	27.6		27.4	.8	27.4	
20	25.9	7.2	26.8	4.6	26.1	10.1	28.2	5.8	28.6		27.5	2
21	27.2	3.8	27.6	15.7	26	19	24.9	33.1	26.6	20.9	28	
22	27.4		26.9		27.1	15.2	26.2	11.4	27.4		26.2	.5
23	27.8	3.8	26.8	61.5	26.8	4.9	25.8	7.3	27.1	28	27.5	17.8
24	27.8		26.9		26.7	.8	26.3	9.1	27.6	.8	26.4	19.1
25	28.5		27.6	1.3	27.6		26.7	6.4	27.4		27.4	6.6
26	27.7	29.5	26	12.1	25.7	18.8	27.4		27.4	2.5	27.5	2.5
27	25.3	52	27.2	.5	25.8	7.8	27.2	7.2	28.2	1	26.3	.8
28	26	15.7	26.7	2.8	25.8	33.7	25.5	45	27	2	26.8	2.3
29	25.5	3	26.9		25.2	20.1	26.2	19.5	27.8	27.9	26.4	71.4
30	26.3	16.8	27.5	9.9	26.3	14.5	24.9	44.9	25.8	15	24	111.5
31	25.9	17.3	26.3	22.8	25.8	9.4	23.6	59.5	25.4	54.4	24.9	132.6



a

MOUNTAIN ROAD TO BUKIDNON. TAGOLOAN, MISAMIS, TO THE RIGHT, MACAJALAR BAY IN THE BACKGROUND.



b

CANYON PLANTED TO MANILA HEMP AND CACAO, TANKULAN, BUKIDNON.

PLATE I.

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EDITORIAL.

THE COTABATO VALLEY.

By the DIRECTOR OF AGRICULTURE.

The Cotabato Valley has been written up in the PHILIPPINE AGRICULTURAL REVIEW heretofore, but some mention of it may properly be made at this time by reason of the fact that the

eyes of the public are turned in that direction as one of the places in the Archipelago where rice might be grown to make good, at least in part, the amount which is imported from abroad.

Few people even in the Philippines appreciate the great areas of land well adapted to one or another of the various agricultural crops which are still entirely unused.

Along the Cotabato River as far as Fort Pikit, and by report much further, there are thousands of hectares of land of the highest fertility in the same virgin condition that it has been for ages. The Moros have small settlements occasionally, and a narrow ribbon of the land immediately fronting on the river is cultivated in a very primitive way, but the amount in use is negligible.

With regard to its adaptability to rice cultivation there seems to be no doubt, but experiments must be carried on, and studies made, in order to learn whether or not irrigation is needed, and for the settling of many other questions.

There can be no doubt, however, that the Cotabato Valley is extremely rich, and that the area is sufficient to furnish a food supply for many thousands of mouths.

HORTICULTURAL EXPLORATIONS IN MINDANAO AND IMPRESSIONS OF BUKIDNON AND BUTUAN.

By P. J. WESTER, *Horticulturist*.

In making one of his annual trips of inspection during the summer of 1912 of the Provinces of Mindanao under his jurisdiction, the Hon. Dean C. Worcester, Secretary of the Interior of the Government of the Philippine Islands, invited the Director of Agriculture, Mr. F. W. Taylor, to send with him representatives of the Bureau to make observations and study the places visited from the viewpoint of their respective fields of work.

The writer was directed by Mr. Taylor to accompany Mr. Worcester on this trip representing the division of horticulture. Arrangements had been made to join Mr. Worcester in Iloilo when information was received that the Insular Coast Guard *Polillo*, carrying Mr. Worcester and party, had been disabled in Cuyo, and the writer, together with Dr. F. C. Gearhart, chief of the division of animal husbandry, therefore proceeded direct to Cuyo on the Insular Coast Guard *Basilan*, which was ordered to take the place of the *Polillo*.

The *Basilan* left Manila July 26 and arrived at Cuyo the 28th, where the writer and Dr. Gearhart joined Mr. Worcester, Col. J. G. Harbord, Acting Director of the Philippine Constabulary, Sr. Manuel de Iriarte, Second Assistant Executive Secretary, Messrs. W. C. Bryant, governor of Agusan Province, F. Lewis, superintendent of exchanges Mountain Province and former governor of Agusan, J. R. Arnold, Executive Bureau, Frederick Worcester, and F. W. Sweitzer, stenographer.

From Cuyo the party proceeded to Calusa Island, where a short stop was made, and from there to Iloilo, where we were joined by Dr. W. S. Sherfesee, Acting Director of Forestry. Thereafter the itinerary included Siquijor, Siquijor; Butuan, Agusan; and Agusan, Misamis; from here we visited Tankulan, Maluco, and Sumilao in Bukidnon; at this place the writer left the rest of the party and returning to Agusan, explored Cagayan, Tagoloan, Villa Nueva, Talisayan, Alubijid, and Opol, Misamis.

Colonel Harbord returned to Manila. The remainder of the party returned from Bukidnon to Tagoloan August 10. Short stops were made at Jassan and Balingasag, Misamis, and the better part of a day was spent in Zamboanga and vicinity. Olutanga, Sarangani, Davao, Piso, Mati, and Baganga, Davao; Surigao, Surigao, and Butuan, Agusan, were next included in the itinerary. Messrs. Sherfesees, Bryant, and Mr. Stadtmiller of the Bureau of Forestry, who had joined the party in Zamboanga, made the trip overland from Davao, Moro Province, to Veruela, Agusan. The rest of the party proceeded up the Agusan River and its tributaries from Butuan in several small launches and the overland party joined them at Talacogon. Numerous towns were visited in the interior of Butuan, among others San Vicente, Amparo, Las Nieves, Esperanza, Sagunto, Bunauan, Loreto, and Veruela; the party arrived at Butuan again August 29 and returned to Manila September 2. While the weather at sea was frequently rough and unpleasant, the overland trips and stops were almost always accompanied by favorable weather, which greatly assisted in making the excursion a pleasurable one and facilitated the work performed.

During the trip the writer obtained living plant material of seventeen varieties of bananas, including Angao, Amas, Banegas, Bangaan, Binaoy, Binangay, Canton, Dool, Daliao, Inambac, Kadisnon, Kanala, Kilanpilan, Longsing, Masecampo, Sinañgil, and Tumbaga; Baño (*Mangifera verticillata* Robinson) and Juany (*M. odorata* Griff.), two fruits related to the mango; Marang (*Artocarpus odoratissima* Blanco) and Togop (*Artocarpus elastica* Reinw.), two fruits related to the breadfruit; Kambog (*Dillenia speciosa* Gilg.), Libas (*Garcinia vidalii* Merrill), Durian (*Durio zibethinus* Lam.), Kayam (*Inocarpus edulis* Forst.); "Romano," an early fruiting variety of the coconut, Macopa (*Eugenia malaccensis* L.), and the sago palm (*Metroxylon rumphii* Mart.). Budwood was obtained of nine types of citrus fruits new to the writer, cuttings of *Vanilla philippinensis* Rolfe and one unidentified species of *Vanilla*, seeds of a *Phaseolus*, said to be very productive and the beans equal in quality to the Lima bean, two unidentified grasses, and two legumes that may prove valuable for forage. Material of over thirty species of new ornamental plants was also brought to Manila. The fruits collected on this trip, excepting the banana varieties and the citrus fruits, are discussed in a separate paper in the REVIEW.

The writer wishes to acknowledge his indebtedness to Mr. Worcester for the many thoughtful courtesies extended during the

trip which enabled him to secure much plant material that otherwise would have been unobtainable. The identifications have been made by Mr. E. D. Merrill, botanist, Bureau of Science. Unfortunately, the stops in many places were of too short duration to allow more than a few observations; however, these will be useful in the event of another collection trip to Mindanao.

The short stop made at Siquijor, the small island south of Negros, permitted little to be accomplished. A large date palm (*Phoenix dactylifera* L.), at least twenty-five years old and in excellent condition, growing in the convent garden, was an object of great interest, and to all who have contended that the date will not grow in the Philippines this palm furnishes excellent proof of the contrary. (Plate III, *a*.) A grape vine (*Vitis vinifera* L.) was another interesting plant noted in the convent garden, which, according to Mr. Worcester, was in bearing already in 1888 when he first visited Siquijor. This is the same variety that is found in Cebu and several other places in the Archipelago. Several large and thrifty vines of this grape were noted in Cagayan, Misamis, Agusan, Misamis, and Tagoloan, Misamis. The fruit is not the very best, but its vigor and health are all that can be desired and encourage the introduction into the Philippines of other grape varieties of better quality. Budwood of a hitherto unknown type of lemon was obtained in Siquijor.

Misamis is a low coastal province whose principal crops are coconuts and corn, and the larger towns thrive on the export trade of the interior. In Cagayan, the most important town visited in this province, lanzones are so frequently planted that they almost give the impression of growing wild; Plate II, *a*, well illustrates the conditions under which they are grown, interplanted with coconuts; Plate II, *b*, shows the habit of the lanzon and the size the tree attains. Two interesting varieties of what is probably *Citrus hystrix* DC., "Suha" and "Balincolong," were secured here, and in Tagoloan an exceedingly vigorous and distinct variety of the lime, known locally as "Limao;" "Pangapogon" is an unidentified species of *Citrus* found in Alubijid. From the information gathered it would seem that the "Suha" in Misamis is identical with the "Biasong" in Cebu of which material has been collected by Mr. George G. Weathersbee.

Quite a large number of species of fruit trees are found in Cagayan and adjacent towns, including the yambo, rare even in Philippines, and a white-fruited form of *Eugenia malaccensis* L.

The Baúno, *Mangifera verticillata* Robinson, (Plates III, *c*, and IV), to which further reference will be made presently, was

not found east of Talisayan in Misamis, though it is abundant in Butuan. Kayam, *Inocarpus edulis* Forst. (Plate VIII), was found growing in Talisayan, carrying a large crop of nearly mature fruit. The species seems to be but sparsely distributed in the Philippines. In fact, the tree in Talisayan was the only one seen during the trip. It is doubtful whether many places of the size of Balingasag, Misamis, can show as large a collection of bananas—twenty-seven varieties—as was here found by the writer.

Bolót, *Dioscorea fasciculata* Roxb., is grown to a considerable extent, comparatively speaking, around Tagoloan to Villa Nueva and is claimed to be superior to the Ube, *D. alata* L. In most places visited in the province locusts had damaged the coconuts more or less severely. A fruit fly infesting the mango was found in Cagayan.

Coconuts are the leading crop in Zamboanga and the adjacent country, and, seemingly, they succeed very well there. For the benefit of REVIEW readers outside of the Philippines who labor under the delusion that the nearer the equator the warmer the climate, it may be stated that Zamboanga, notwithstanding its latitude, has the reputation of being one of the coolest towns on the seaboard in the Philippines; the well-kept roads and clean streets speak volumes for the efficiency of all who are responsible for these conditions. Here, as everywhere else, bananas are the leading fruit. Large papayas and soursops of excellent quality are grown here in greater abundance than in any other place in the Archipelago that has come to attention of the writer.

Notwithstanding its good communication with Manila, Cebu, and Iloilo, where the mango is one of the leading fruits, the mango has not been well introduced into Zamboanga. More abundant than the mango is here the Juany, *Mangifera odorata* Griff., well named indeed, for a few fruits of this species are sufficient to “perfume” a large house. The main season of maturity of the Juany coincides with the mango, though the writer was informed that a few ripe fruits may be had at all seasons of the year. The fruit is far inferior to the mango. The Juany was found in abundance both on the south and east coast of Mindanao as far as Mati. Three other fruits, new to the writer, were obtained in Zamboanga, the Baúno, Marang and Durian, described in detail on another page of the REVIEW; Banegas, a large, yellow banana, also obtained in Zamboanga, is one of the best flavored bananas that has come to the attention of the writer, greatly superior to the Lacatán in aroma and flavor.

Manila hemp and coconuts are the two staple crops in Davao. The planting of coconuts is increasing at the expense of hemp, and the planters seem to be well justified in thus placing confidence for the coconut plantations seen in both Davao and Piso were in a flourishing condition.

The four days spent in Bukidnon and the seven in visiting the towns located on the Agusan River and its tributaries gave an opportunity to study the agricultural and horticultural conditions in these regions better than in any other place visited, though a longer stay and a trip further southward would have been desirable in Bukidnon.

The Agusan Province as constituted at present is divided into two subprovinces, the first of which, Butuan, is bounded by Surigao on the east and the Davao district of the Moro Province on the south; on the east lies Bukidnon, the second subprovince, and on the north the Surigao Sea. Butuan has a precipitation of 2,137 millimeters well distributed throughout the year, falling mainly during October, November, December, January, February, and March; August is the driest month of the year. Agusan, the largest river in the Philippines, flows through the center of the province in a northerly direction, reënforced by numerous tributaries from the east and west along its entire course. It is navigable for light-draft launches (including the tributaries and canals that have been made across the swamps) for about 150 miles, according to Mr. Lewis; hemp is the chief export of Butuan.

A serious earthquake occurred in the upper Agusan Valley in 1903 which resulted in the settling of a large area, the river flowed backward, and the so-called "lake region," from Talacogon to Veruela came into existence. This region is still visited by frequent seismic disturbances, and the entire district is reported to be slowly sinking.

A trip on the Agusan is unique in its kind in the Philippines. From the mouth of the river to Butuan, the land is low, barely above tide water. Some coconuts are planted with here and there a sago swamp. From Butuan to Talacogon the elevation of the land above the river is greater, and the land wooded, the trees overhanging the river being frequently draped to the water with climbing plants, mostly belonging to Leguminosae and Convolvulaceae, in the greatest profusion, giving a charming effect; small clearings are passed from time to time, planted to corn and hemp. The climbing rattan palms, the tops of which rise above the rest of the vegetation, and a few fishtail and "Palma-

brava" palms, tend to relieve what after a while becomes almost a monotonous landscape. According to Mr. Worcester this land is practically never flooded.

The elevation of Talacogon is said to be slightly more than 30 meters. Above Talacogon to Veruela the Agusan Valley is usually referred to as the "Lake Region." The rivers at normal heights here flow some 6 meters below the river bank and then again they overflow the banks and inundate the country. The river bank frequently slopes downward away from the river leaving a more or less impenetrable swamp beyond. In the inundated sections of the lake region the land is frequently covered with aquatic grasses and other herbs of luxuriant growth; at a slightly higher elevation, pandans with tall slender trunks make a picturesque addition to the landscape. On the lower half of the river bamboos are entirely absent, and in the lake region, where they are present, they consist of a dwarf bushy species with slender thin-walled canes unsuitable for building purposes. Epiphytic orchids occur almost everywhere in more or less profusion, and one of the interesting discoveries of the trip, *Vanilla philippinensis* Rolfe and one unidentified species of *Vanilla*, was made at Loreto, where it was found to grow in the greatest luxuriance, though in rather limited quantity. As far as is known no attempts have been made to obtain vanillin from these species, and plants were brought to Manila with a view of ascertaining whether or not the species are of economic value.

The Durian and Baúno are evidently indigenous here, and durian trees were seen that were estimated to be 20 meters in height and baúnos some 12 or more meters; bananas and papayas are abundant, but other fruit trees rather scarce, due to the comparatively recent civilization of the folk tribes occupying the country, their lack of communication with the outside world, and probably in no little measure to the fact that the river overflows its banks annually having at those times probably destroyed many introduced fruits in the early stages of the growth of the plants before they had the opportunity to become established. Under such circumstances it was surprising to encounter in Sagunto cacao trees in the best possible condition which were estimated to be at least forty years old.

During the short rainy season in November and December it is said that most of the "lake region" is covered with water until only the tree-tops are visible, and that the streets in many towns are navigable for rowboats when the floods come. Where such conditions obtain it is perhaps doubtful, in fact improbable, that

the country will ever become of much value agriculturally or horticulturally except for a people whose needs are few and who are content to live a primitive life. Yet during the season when the rivers are of normal height, rice and corn can undoubtedly be grown in the Agusan Valley in considerable quantities. However, considering the large areas of unoccupied land in the Philippines more readily accessible, more healthful, ready for the plow without any preparation save the burning of the native grass, it is questionable whether it would be advisable to colonize a country that is admittedly more or less unhealthful, swampy, subject to annual inundations and forested, the clearing of which would be costly and difficult. Judging from the appearance of the cacao trees seen here and there the encouragement of the planting of cacao by the natives would seem well justified in the more elevated regions of the valley. Pará rubber is likely to succeed, but the country is unsuited to the Ceará rubber.

Some day, when the more elevated sections of the valley to the east and west are opened to civilization, the Agusan and its tributaries, with some dredging and canal construction, will become the arteries of the province and provide a cheap and efficient mode of transportation.

Sago swamps covering more or less extensive areas are found from Butuan northward, and south of Talacogon, but it is problematical whether their extent is large enough to warrant the introduction of modern machinery for the extraction of sago; however, it is a situation worthy of investigation. At present the sago palm furnishes a cheap, nourishing, and easily obtainable food for the native inhabitants wherever it grows.

The sago palm, *Metroxylon Rumphii* (Plate III, *b*), has never been accorded the attention it deserves from civilized man. No starch-producing plant in the world will grow with so little attention; it flourishes on land on which most crops fail, and once established, it is established forever, for unlike most other palms the sago suckers freely from the base and the creeping stem, and sooner or later it may be found desirable to extend the sago swamps in Mindanao and perhaps to establish sago plantations in other parts of the Philippines. This interesting subject will be discussed in a future issue of the REVIEW.

Bukidnon, the sister province of Butuan, lies to the southeast of the latter, from which it is separated by a mountain range; south of Butuan it is bounded on the east by the Moro Province, which also surrounds Bukidnon on the south and east; on the north the province is shut out from the sea coast by the narrow coast province of Misamis. Bukidnon is very sparsely pop-

ulated, the population being estimated at about 27,000 by Mr. Lewis. No records of the temperature and rainfall are available, but as far as has been ascertained the latter is abundant and well distributed throughout the year. The least rain falls from January to April, but there are no continued dry spells.

Owing to the altitude the air is comparatively cool and refreshing and the nights almost cold. The climate is cooler and more agreeable than that on the coast and in the Agusan Valley and Bukidnon may justly claim the distinction of being one of the most healthful provinces in the Archipelago; typhoons are unknown.

Bukidnon is in many respects the radical antithesis of Butuan. In Butuan the inhabited country is low and inundated and rivers and canals afford the means of transportation; in Bukidnon mountain trails are the means of communication. The province may be said to be a vast tableland, with a probable mean elevation of the plateaus of 360 to 540 meters, not infrequently exceeding an altitude of 750 meters, the plains separated by mountains, canyons, and ravines, in the bottom of which flow numerous mountain streams and rivers. South of Tankulan all supplies and products are transported on the back of the carabao or the pack horse.

The main entrance into Bukidnon is the road leading from Agusan, a barrio of Tagoloan, to Tankulan, the construction of which has progressed sufficiently to be passable for wagons. (See Plate I, *a.*) The topography of the country has necessitated winding roads on the mountain sides and in the canyons, here ascending, there descending, though there is a steady ascent from Agusan over Tankulan and Maluco to Sumilao, said to have an altitude of 810 meters.

The scenic grandeur and the vegetative wealth increase in a geometrical ratio as one penetrates the interior. In the canyons an exuberant vegetation, including trees, herbaceae, ferns, here and there in tree form, climbers and orchids, prevails.

The plain reached after the first ascent was disappointing after the glowing reports that had been heard of the fertility of Bukidnon. The land here, which lies partly in Misamis, is sandy, gravelly, and stony, and supports a scanty vegetation, mainly grasses with occasional scrubby trees. The plains beyond what may be termed as the second ascent, consist of rich loamy or clayey soil, supporting a luxuriant growth of native grasses. The mountains and hills are frequently grass-covered to the summit and where they are wooded cinnamon grows wild in many places. Here is also found a stout, thick-walled bamboo

that is much superior to the bamboo used in Manila, and which ought to be introduced into other parts of the Philippines.

At present an infinitesimal area is cultivated by the native inhabitants, who a few years ago were but slightly above absolute savagery, living in the forests, which they have been induced to leave through the instrumentality of the provincial authorities and to settle on the plain. The government also extends to them "first aid" in breaking the virgin sod for them and assists them with seeds and plants of vegetable crops and fruits and plans their villages. If the existing natural vegetation on the plains was not already sufficient proof of the wealth of the soil, the growth of corn, upland rice, camote, cassava, and the fruits that have been introduced and are thriving certainly furnish convincing evidence to this effect. The need of the introduction of better varieties of corn is very evident.

Coffee, *Coffea arabica* L., is planted more or less in all settlements in Bukidnon, but it is improbable that it will ever become profitable except on the highest plateaus, because of the ravages of the coffee blight, *Hemileia vastatrix*. In fact, the blight is present in all coffee plantations visited in Bukidnon, but the disease seems to be innocuous above a certain altitude. According to Mr. Worcester the blight was very destructive here even when he first visited the region, when little care was taken of the trees and grass and weeds were allowed to crowd the plants. The natives having been persuaded to rigidly clean-cultivate their coffee, the coffee plants now seem to have gained sufficient vigor to resist the blight and are very productive. After the discouraging disappearance of the coffee ranches in the other parts of the Archipelago, this is almost too good to be true; nevertheless, it is a fact that there is a sufficient area of land in Bukidnon where coffee apparently can be profitably cultivated to supply our entire home demand, judging from the results attained during the last few years. However, it should be remembered that the blight is present everywhere, and that any condition that would have a tendency to devitalize the coffee plants would also in all likelihood invite an outbreak of the blight. Sumilao, Impasugong, Kalasungay, and Alanib are the centers of coffee growing, and the coffee produced there is of excellent quality.

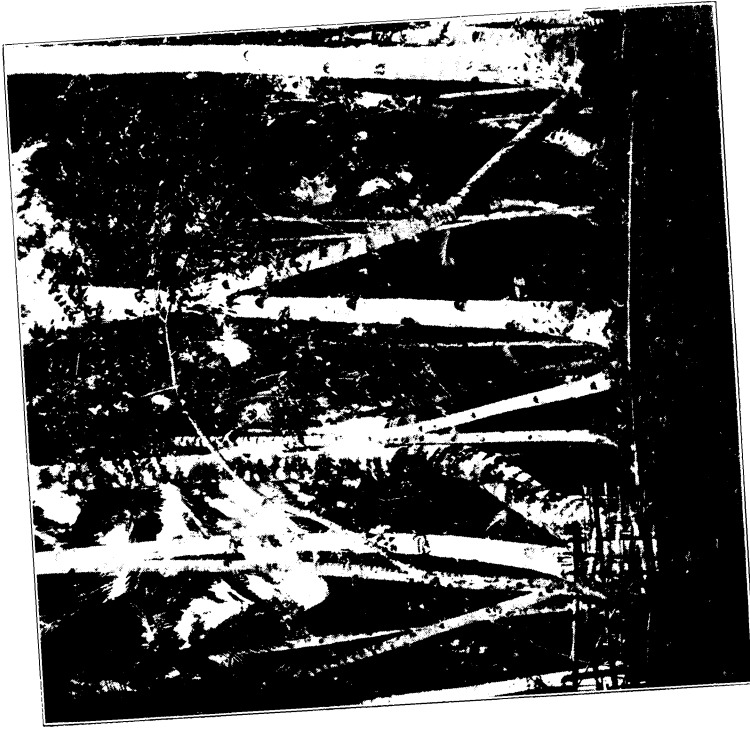
The variety of fruits grown in Bukidnon is rather limited, though this is not surprising, considering the isolation of the province and how difficult transportation was in days gone by. Aside from the ever present banana and papaya, the lanzon is very plentiful in Sumilao, but the fruit produced here is said

to be inferior to that grown near the seacoast. The lanzon was here just coming into bloom, while at the same time it was offered in the market in Manila and Zamboanga. Oranges of remarkably good flavor were found in the convent garden in Sumilao and also limes, unsurpassed in productiveness, appearance, coloring, texture, juiciness and flavor. Unfortunately a fruit fly which infests the orange has found its way here. Pineapples are cultivated quite extensively in Bukidnon, comparatively speaking, while one also finds the jak, breadfruit, coconut, mango, sugarapple, soursop, guava, mandarin and lemon.

Cacao is grown in the canyons around some of the villages, notably Tankulan (Plate I, *b*), but the scaling of the cliffs in the transportation of the beans produced and of tools for the cultivation of the trees is too difficult to ever tempt the white man to utilize the canyons for this purpose. Hemp is also grown in the canyons; in fact, this is the principal export of the province.

With the advantages here discussed there is the present disadvantage of isolation from the outside world owing to the difficulty of approach, although a kind Providence has provided against this inconvenience in the falls and rapids of the rivers which could be harnessed and supply cheap motive power for the equipment of an electric railway. Thus the great distances would be annihilated and the days it now takes to travel would then be reduced to little more than hours, with the cost of transportation proportionally lessened, and Bukidnon, which, with its magnificent natural beauty, healthful climate, fertility of soil, abundant rainfall well distributed throughout the year, freedom from tropical storms, and an abundance of water for power, irrigation, industrial and transportation purposes, possessing perhaps more combined natural advantages than any other section in the Philippines, would be within a few days of Manila, and one of the trade routes of the world.

Generally speaking, the Tropics, with their opportunities for the exploitation of cheap and ignorant labor, have hitherto attracted the capital of the avaricious Caucasian rather than himself, and therefore, even in our day with its plentiful and cheap and widely diffused literature, the knowledge of the Tropics by the average citizen, be he American or European, is very hazy to say the least; to him it is the home of sweltering heat, terrific typhoons, malaria and fevers, mosquitos, lions and tigers, and dangerous snakes, a land unfit to live in, to say nothing of the more or less cannibalistic and savage inhabitants of the genus *homo*. While it is true that many parts of the



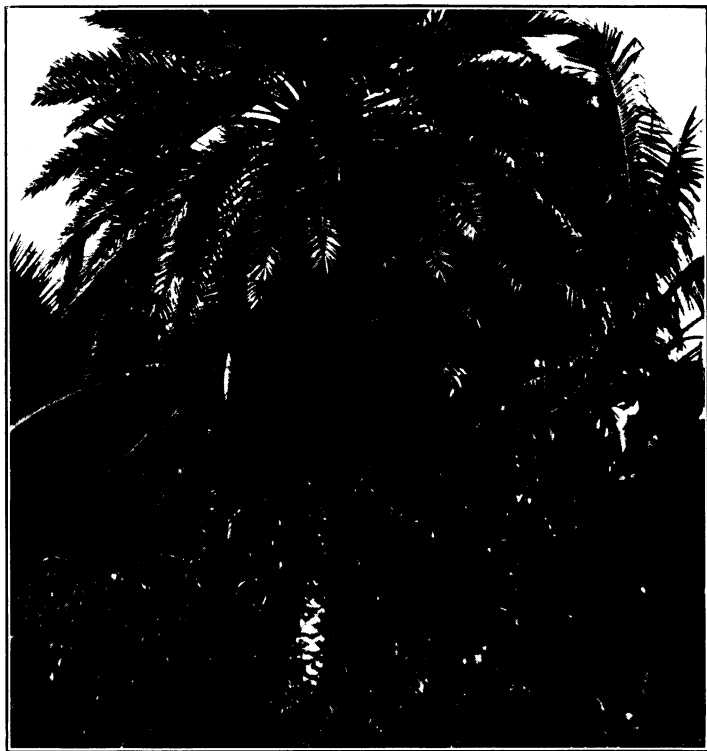
a

TYPICAL LANZONE GROVE IN CAGAYAN, MISAMIS.



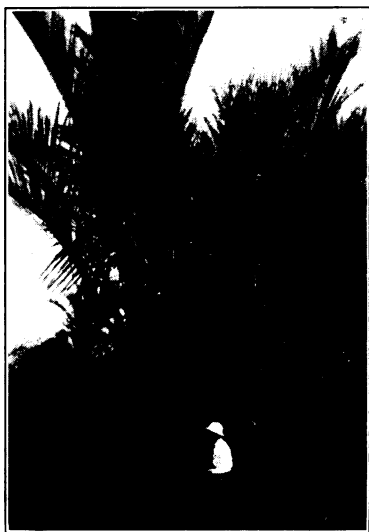
b

FULL-GROWN LANZONE IN CAGAYAN, MISAMIS.

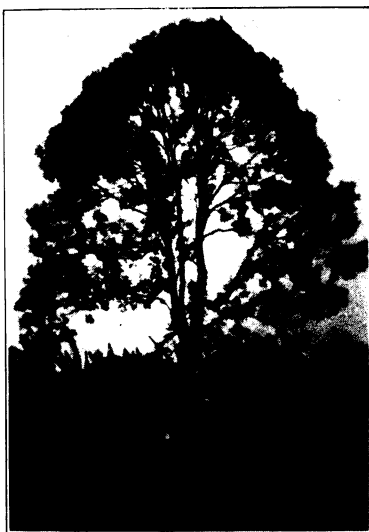


a

DATE PALM (*Phoenix dactylifera* L.) IN SIQUIJOR, SIQUIJOR.



b



c

SAGO PALMS (*Metrostylon rumphii* Mart.), BAÑO (*Mangifera verticillata*, Robinson),
VERUELA, BUTUAN. TALACOGON, BUTUAN.

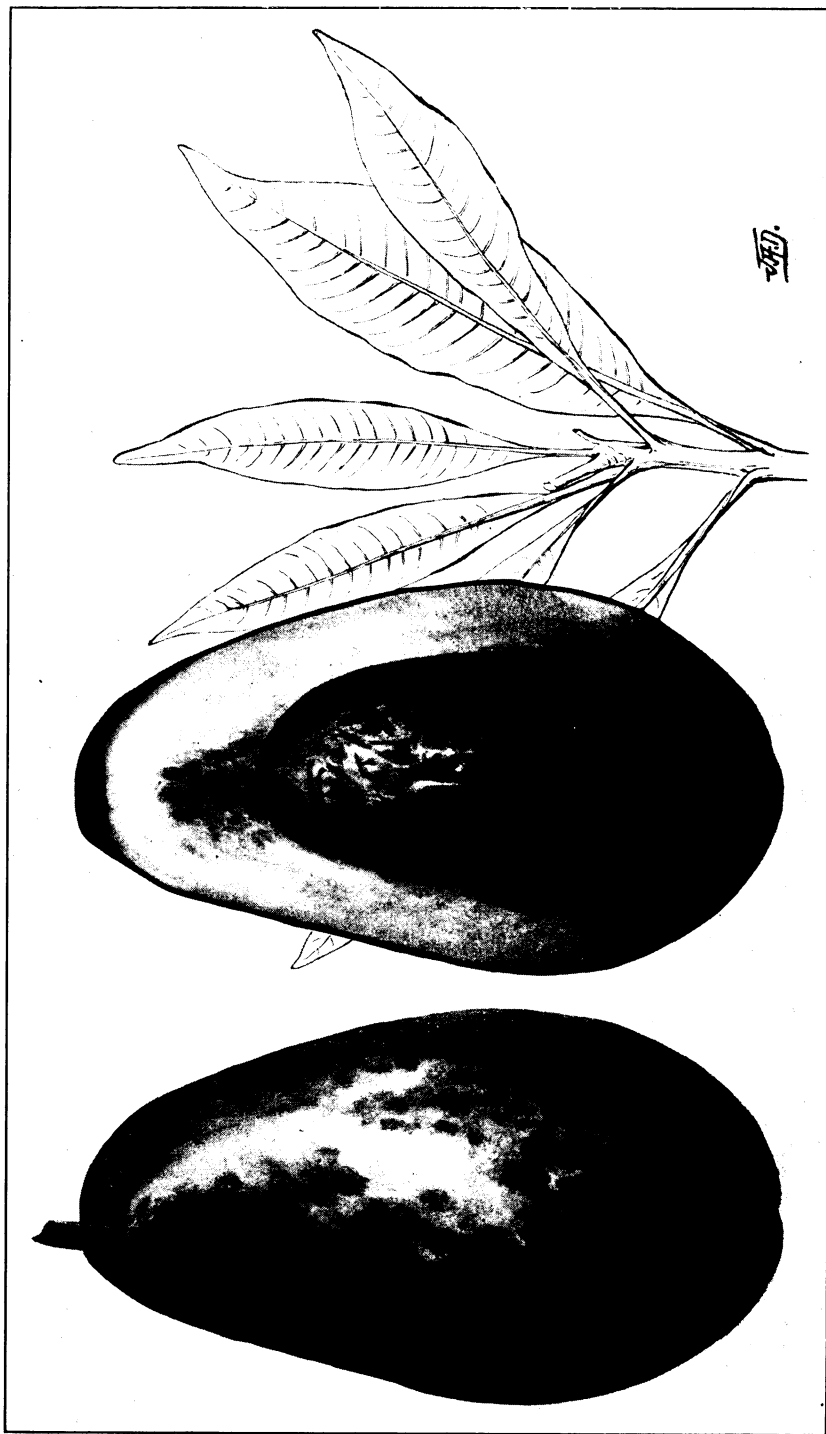


PLATE IV.—BAÑO (*Mangifera verticillata*, Robinson) —FRUIT TWO-THIRDS, LEAVES ONE-HALF, NATURAL SIZE.

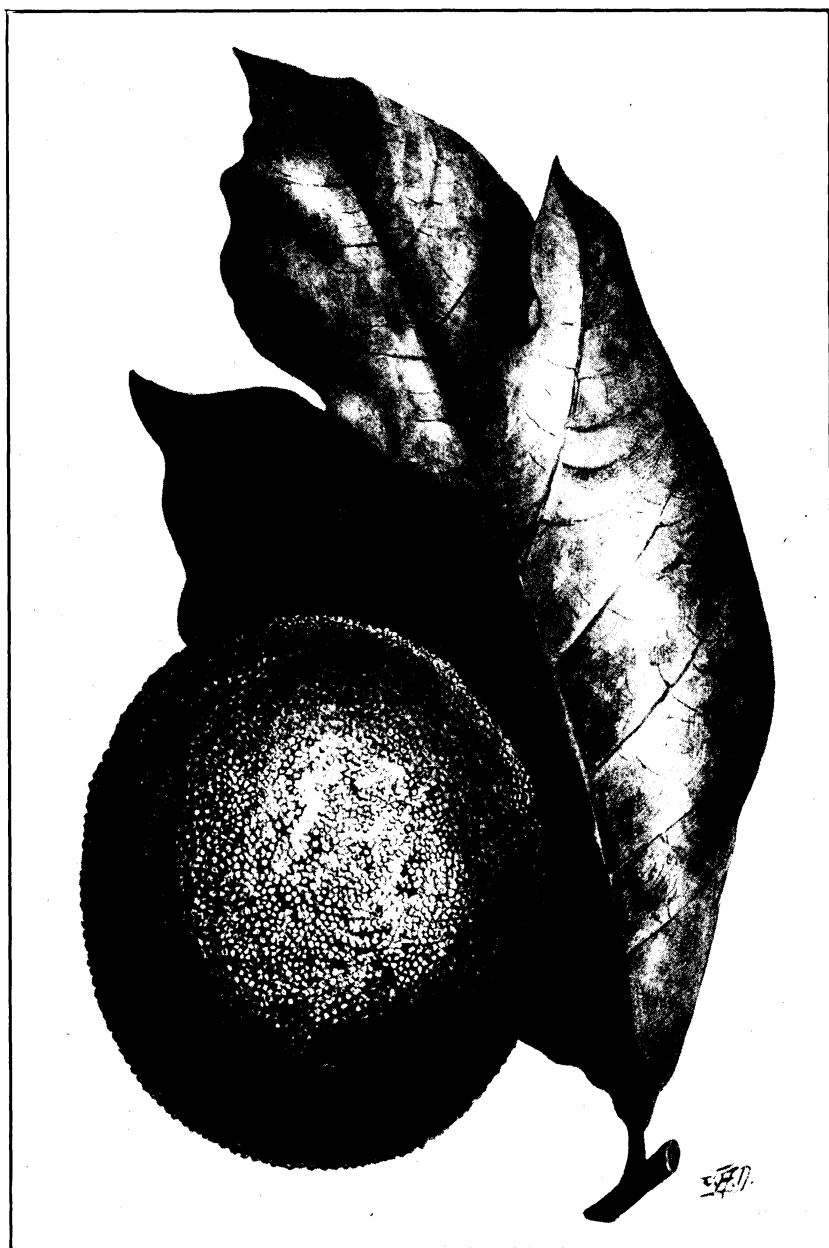


PLATE V.—MARANG (*Artocarpus odoratissima*, Blanco)—FRUIT ONE-HALF, LEAF ONE-FOURTH, NATURAL SIZE.

Tropics are subject to the above-mentioned disadvantages, yet those of us who have lived in the Tropics or subtropics know how woefully incorrect are these conceptions of large regions of the Torrid Zone. No small measure of this ignorance of the climatic and other conditions of the Tropics has been dissipated in the United States as a result of the construction of the railway through the east coast of Florida to Key West—which also had a disreputable reputation until within the last few years—with its consequent influx of a large army of men of moderate means who are rapidly building up thriving communities in that part of the state. The construction of the Panama canal has been another potent factor in dissipating this ignorance.

A majority of the people do not anticipate nor have they any ambitions to become millionaires or even wealthy; they are content with an opportunity to make a comfortable and independent living with sufficient means to provide their children with a good education. It is these that are settling south Florida, engaging in fruit and vegetable growing on farms which are 4 to 30 or more hectares in area. Much of agriculture in the Tropics is an intensified form of farming, more properly called horticulture, and thus a small area of land provides ample support for a family as compared with the land necessary in the Temperate Zone, where cereals are the leading crops. Bukidnon, after the construction of an electric railway from the coast to the interior, with its virgin soil, almost uninhabited, possessing the natural advantages which have already been dwelt upon, would seem to offer an excellent opportunity for colonization by small landholders of the class mentioned and such a class would not be so dependent upon a scarcity of suitable labor which so frequently is the bugbear of the moneyed investor in the Tropics. Pineapples and various other fruits could here be grown for canning purposes, citrus fruits for export, coffee on the higher plains, and cacao on the lower elevations. Corn, upland rice, various legumes, sugar cane, cassava, camotes, and yams have demonstrated their adaptability to the climate and soil. Whether cinnamon culture would be profitable is perhaps debatable, but it should not be forgotten that this plant grows wild in the foothills of the mountains and that the bark obtained is of excellent quality. Certainly no other province in the Archipelago offers a more attractive field for immigration for the inhabitants in the over-populated provinces in the Philippines, such as Cebu and Bohol, than Bukidnon.

Until the plains shall have been brought under cultivation and developed agriculturally and horticulturally, they will for

years provide excellent pasture for large herds of cattle, and even when the plateaus shall have been converted to waving fields of corn, rice and sugar cane, plantations and orchards, much of the broken country will still remain unoccupied for pastoral pursuits.

Whether or not the suggestions above receive serious consideration from those who are in a position to further the colonization of the unoccupied territory of Bukidnon, the provincial Government officials of the province have here one of the very best opportunities to benefit this and coming generations, and to erect to themselves a lasting monument by the planting of avenues of mangos and other fruit trees for shade along the roads over the wide plains. As has been pointed out in a previous issue of the REVIEW, fruit trees are frequently utilized in Germany as shade trees and there is no reason why Bukidnon should not set the pace in the Philippines, not to say in the Tropics.

The roads in Bukidnon, and the settlements of the natives upon the plains reflect great credit on those who have engineered this project, and so do the sanitary conditions there. The cleanliness of the villages is beyond praise and they are in this respect perhaps unexampled in the Philippines.

THE DURIAN.

By O. W. BARRETT, *Chief, Division of Horticulture.*

The faultless fruit has not been found. Fruits there are, to be sure, which evince relationship with the Golden Apples of Hesperides, others without which the local inhabitants could scarcely exist, and others still which are delightful both to look upon and to taste.

There are also many fetid fruits as well as fragrant, but the most famous, the best, and perhaps the biggest of ill-smelling fruits is the Durian (*Durio zibethinus*). Without the unpleasant effluvium of this justly famed fruit, the mangosteen with its deplorably small quantity of pulp would have to look to its laurels as the best fruit of the world; for as regards size there are only a few of the tree fruits in popular esteem that can compare with the 2-kilogram (5-pound) Durian—nearly one-third of which is edible pulp and about one-sixth of which is edible seeds; nor can many fruits show a sugar content of more than 12 per cent with about the same amount of starch besides, and only a little over one-half water.

Some forty years ago the great naturalist Wallace made the statement that "to eat Durians is a new sensation, worth a voyage to the East to experience." And three hundred and thirteen years ago a Dutch botanist, Linschoten, declared it to surpass in flavor "all the other fruits of the world." Possibly the writer may have been spared the usual prejudicial impressions of the fruit by having been introduced to it a few years ago by no less an authority on tropical fruits than Dr. H. N. Ridley, the then Director of the Singapore Botanic Gardens.

The Durian is a native of Malaysia in a strict sense of the word, i. e., it grows well only in those countries inhabited by the Malay people—from the northern Federated Malay States through the Dutch East Indies and up into the Philippines as far as northern Mindanao. It has been introduced into most

of the tropical countries but generally only as a botanical garden or greenhouse specimen. It is usually considered as belonging to the Malvaceæ, or the family of the mallows, hibiscus, etc.; it has also been placed in the Sterculiaceæ, or cacao family. It is a question if the genus should not be given a separate order by itself since in many ways it is very distinct from the ordinary malvaceous plants and, by the same token, it scarcely resembles the cacao relatives except in point of the interior of the fruit. The tree itself is magnificent and stately, growing usually in open country in edges of forests, around native villages, and in clearings. It can hardly be called a cultivated fruit tree; at least, it is hardly ever grown in orchards, although on the other hand it could hardly hold its own in the wild. Throughout Malaysia it is considered the most delicious, if not the very best fruit, at least by the natives. Europeans, of course, generally consider the unpleasant odor of the fruit an insuperable factor; a fair proportion, however, of the foreign residents soon grow to relish the Durian and sometimes become staunch advocates of its use. Although it would not be wise, perhaps, for one unaccustomed to the fruit to consume a large quantity of the pulp at one sitting, there is apparently no substance in it which would cause indigestion or anything beyond a rather unpleasant breath for a few hours after eating.

According to the specific name, *zibethinus*, the fruit should osphresiologically remind one of the civet cat; the writer, however, after having seen and smelled live civets in Mozambique, does not concur in this idea. Neither is the odor like that of old cheese, nor of garlic, nor of onions, but it is of a nature peculiar to no other fruit. The taste suggests some multiple-flavored, aromatic custard, with a *soupeçon* of turpentine, like the mango. The chemical body which is responsible for the very pronounced odor is probably one of the sulphur compounds with some base perhaps related to that in butyric acid; it is not an oil nor a sugar, not a true starch nor an inulin, but according to Dr. W. E. Pratt, a chemist of the Bureau of Science, who is probably the first chemist to make a thorough analysis of the Durian, it is a substance new to the organic chemist. The pulp contains a compound which, it is believed, is related to erythrodextrin but seems to exist, if such, in a new form in this fruit.

The principal features of the Durian's make-up are shown in the following table, an abstract from Dr. Pratt's forthcoming analysis:

Average weight of fruit (Jolo variety)	grams....	2,200
Average weight of rind (including spines)	do.....	1,200
Average weight of seeds	do.....	350
Average weight of pulp	do.....	650
Acidity	per cent....	0.1
Sugar	do.....	4.8
Sucrose	do.....	7.9
Proteids	do.....	2.3
Starch	do.....	11.0
Total solids	do.....	44.5
Ash	do.....	1.24

The seeds contain nearly pure starch; they are good either boiled or roasted, like chestnuts.

Like the innocent avocado the Durian has been—probably unjustly—accused of having pronounced aphrodisiac qualities; it is barely possible, of course, that such a reputed character would partly account for the intense popularity this fruit enjoys among the native peoples of its various habitats. Since, by the same token, it is also probable that the native does not fully realize the high nutritive character of the fruit, it would seem very evident that the Durian is eaten for its delicious flavor, purely and simply, and that the (to most people) unpleasant odor is merely a secondary phenomenon which in no way deters 99 per cent of the people acquainted with the fruit from partaking of it.

In passing we should not forget that there are Durians and Durians; some are said to be without a strong odor while to our certain knowledge some of the Borneo varieties are not at all objectionable. Borneo has at least six and probably ten varieties; some of these have only one or two seeds and are comparatively small fruits, while others are fully as large as our largest Jolo or Lake Lanao (Mindanao) forms; the pulp of some is nearly white, while that of others is pale salmon or even *orange* in color.

The Durian is one of the fruit-bat's favorite objects, not only as a tremendously attractive food but the rather ungraceful branches of the tree itself form a very acceptable roost for the flocks of these creatures, which probably have pleasant dreams during the hot, sunny days clinging head downwards to the branches, dreams of the past fruit season's exciting experiences when the appearance of the first crack in the fearfully spiny shell of a fruit was the signal for a grand *mêlée* with whirring wings and shrill ghostly cries. Probably no Durian was ever consumed in peace and quiet on its own stem by either bat or bird of any sort, for

soon after becoming thoroughly mature the very heavy fruit usually falls, sometimes killing or at least severely injuring the unlucky individual who might happen to be underneath. After the bats succeed in breaking the fruit from its stem they can, of course, make no further use of it since they cannot feed upon the ground; it then becomes a treat for the wild pigs or the half-wild swine of the natives.

In short, then, because of the majestic bearing of the tree itself—for there is scarcely a better tree in this respect; for its wonderfully beautiful silvery leaves, which are almost unrivalled in the tree world; for its curious silver-plated, golden flowers which few people, even botanists, have ever seen; for the unique exterior of the fruit—which mocks some of the breadfruits in outward appearance, but whose short brownish spines are so sharp and hard that only with a painful effort can one hold a good-sized fruit on the open palm; for its delicious pulp, with at least five distinct flavors; and last, but by no means least, for its very unique odor which has prejudiced most dilettante connoisseurs and given this near-king among the fruits an unsavory reputation to the world at large—we must needs regard the Durian as one of the most interesting fruit species of the horticultural world.

NEW PHILIPPINE FRUITS.

By P. J. WESTER, *Horticulturist*.

Considering the time that has elapsed since Vasco da Gama and Bartolomeo Dias rounded the Cape of Good Hope, and the time during which the Islands of Malaysia have been repeatedly explored, the average man may think that there is nothing left to discover in this part of the world. Geographically speaking, there is perhaps but little, though there are yet in the interior of the larger Sunda isles, and even in the Philippines, considerable areas that have never been trod by a white man; the naturalist, however, discovers new species almost daily, and even for the horticulturist there are still new fields to conquer. Only recently the Bureau of Agriculture received from Borneo seeds of seven varieties of Durians hitherto unknown in horticultural literature. Dr. O. Beccari quotes the names of twenty varieties of Durians in "Malesia," and describes three other species of the genus *Durio* having edible fruits; he also found several new *Nepheliums* cultivated there by the natives, and Mr. Staniforth Smith, the territorial governor of Papua, in a report of a trip through the interior of that country, speaks of having seen several new fruits there. Even the Philippines still have their quota of fruits unknown except in their native habitat, some of which have not even been described botanically until quite recently.

Excepting the "Tabu," which was discovered by Mr. Worcester in Palawan, the fruits described below were noted in Mindanao by the writer in August of this year, when he accompanied the Honorable Dean C. Worcester, Secretary of the Interior of the Government of the Philippine Islands, on an inspection trip through that island. With the exception of the Durian they are all believed to be new to horticultural literature; plant material of these fruits was brought to Manila for propagation with the idea of improving them through better culture and for the purpose of distributing plants to such localities as may be adapted to them climatically.

Baúno, *Mangifera verticillata* Robinson, also known as Bayono, Bayuno, Balono, or Balún. Anacardiaceæ. (Plates III, c, and IV.) A large tree sometimes exceeding 12 meters in height with a trunk 50 centimeters in diameter, growing in inundated regions in several parts of Mindanao, being particularly abundant around Butuan and in many places in the Agusan Valley and Davao, and occurring also in the Sulu Archipelago. The Baúno resembles the mango in habit and appearance though it is somewhat more upright in habit, of sparser foliage, more gnarled, and less attractive in appearance than the mango. The leaves are 12 to 18 centimeters long, elliptical to lanceolate or oblanceolate, coriaceous, smooth, with a prominent midrib. The flowers are small, blue, and appear in terminal panicles like the mango. There is considerable variation in the appearance, size, and quality of the fruit in the numerous trees. The fruit of the best is somewhat larger than a Carabao mango, from 11 to sometimes exceeding 13 centimeters in length, with an equatorial diameter of 7 to 8 centimeters, oblong oval to pyriform; stem usually inserted obliquely in a more or less irregular sinus; stigmatic area depressed; surface smooth; color yellowish green; lenticels numerous, small; skin very thin and tender, adhering closely to flesh; flesh white, very juicy, rich, sub-acid, quite aromatic, of excellent flavor, partaking somewhat of the flavor of apricot and soursop combined; the one seed is monoembryonic, large, oblong, and encased in matted coarse fibers that penetrate the flesh to more or less extent. The tree blooms in July and August and the fruit ripens in August and September.

The largest and best flavored baúnos were obtained in Zamboanga; very good fruits were found in Davao and Butuan and some that were very poor in Butuan and Surigao. The baúno is evidently very variable pomologically and the trees also seem to differ greatly in productiveness.

The excellent flavor of the Baúno assures this fruit a place among the tropical fruits on a par with the mango, as soon as a facile method of propagating the species asexually shall have been discovered so that material of the best seedlings may be obtained and systematic breeding begun, reducing the fiber in the fruit. Botanically as well as horticulturally the Baúno is a new fruit, having been named and described last year.

Juany, *Mangifera odorata* Griff. A medium to large tree, growing on the south coast of Mindanao and the Sulu Archipelago, differing but slightly from the mango in habit and foliage. The fruit is of about the size of the average mango, roundish

oblique, a trifle flattened; surface smooth; color green with a few large lenticels; skin very thick and tough; flesh yellowish, sweet, juicy, very resinous and very fibrous, odorous rather than aromatic, and to the novice at least, the flavor partakes altogether of too much turpentine to be agreeable; seed large and covered with abundant coarse fiber.

The Juany is far inferior to the mango, and in fact seems to have little if anything to recommend it where the mango will grow. Nevertheless it is found more frequently than the mango on well drained land in Zamboanga, Davao and in several other points visited as far as Mati on the east coast of Mindanao.

Herbarium specimens were also brought to Manila of a tree called "Paho," collected in Talacogon, which were pronounced by Mr. Merrill a species of *Mangifera*, hitherto unknown in the Philippines. No accurate description could be obtained of the fruit which is said to resemble a small mango and to be edible.

Marang, *Artocarpus odoratissima* Blanco, also known as Madang. Urticaceæ. (Plate V.) A medium-sized tree with large, dark-green leaves, entire or more or less conspicuously trilobate, 45 to 60 centimeters long and 25 to 30 centimeters broad, similar in habit to the breadfruit, found in the south coast of Mindanao and the Sulu Archipelago, and was first described from Mindoro. The fruit is large, 16 centimeters long and 13 centimeters in equatorial diameter, roundish oblong, regular, thickly studded with soft, greenish yellow spines about 7 millimeters long on the outside; rind thick and fleshy; flesh white, sweet, rich, juicy, aromatic and of good flavor, separated into segments (of about the size of a grape) clinging to the core; each segment containing a seed; seeds many, whitish, 8 by 15 millimeters, smooth, separating readily from the flesh. When the fruit is ripe, by passing a knife around and through the rind, with a little care the two halves separate from the flesh leaving this like a bunch of white grapes. Ripe fruits were obtained in August. The Marang is far superior to its relatives the jak and the ordinary breadfruits found in the Philippines, and already in its present form is a remarkably good and attractive fruit. The tree was noted by the writer in Zamboanga and Davao.

Togop, *Artocarpus elastica* Reinw. A medium-sized tree, somewhat similar in foliage and habit to the breadfruit, found in inundated regions in the Upper Agusan Valley. The fruit, which was not seen by the writer, is reported to ripen in March, and is said to be of about the size of the Marang and to resemble the breadfruit, to which it is alleged to be superior in quality.

According to Mr. E. D. Merrill, the Togop is not found in the Philippines outside of Mindanao.

Kambog, *Dillenia speciosa* Gilg. Dilleniaceae. (Plate VI.) A very ornamental tree, attaining a height of 10 to 15 meters, with large, elliptical oblong, serrate, dark green leaves, 45 to 50 centimeters long, and 18 to 22 centimeters broad, found in Mindanao, the Visayas, and in some parts of Luzon. The fruit is about 55 millimeters long, and 75 millimeters in equatorial diameter, broadly cordiform, greenish, smooth and shiny. The sepals are persistent and grow large and fleshy, inclosing the edible part of the fruit; the interior consists of numerous carpels, greenish, fleshy, subacid, adhering to a central core around which they wind spirally, each containing one or more small seeds, which separate readily from the flesh. Mature Kambog fruits were collected in August by the writer in Loreto on trees growing on inundated land.

Libas, *Garcinia vidalii* Merrill. Guttiferæ. (Plate VII.) A small ornamental tree, attaining a height of 10 meters, with large, roundish oblong, thick, leathery, dark-green leaves, with short petioles and prominent midrib. Rather rare north of Mindanao. Fruit roundish, 50 millimeters long and 54 millimeters in equatorial diameter, smooth, with numerous small lenticels, stigmatic area quite large and prominent. Mature, the fruit is said to be rather acid and of good flavor. The fruits obtained by the writer were fullgrown but too immature to permit testing. The only tree of this species noted was seen in San Vicente, Butuan. The species is evidently quite vigorous, and may, aside from its pomological value, prove a good stock for the mangosteen, to which it is related.

Tabú, an unidentified species, said to grow on a vine, obtained by the Hon. Dean C. Worcester, at Separation Point, Palawan, who presented seeds to the Bureau of Agriculture through the writer. The fruit is of about the size of a pomelo, with a thick, smooth rind that separates from the flesh. According to Mr. Worcester, the flesh consists of a large number of juicy, subacid segments, separable from each other and the rind similarly to the mangosteen, which fruit the flesh also strongly resembles in flavor. Altogether the Tabú is reported to be a very attractive and well-flavored fruit. The mature fruits were obtained in July and the writer had unfortunately not the opportunity to sample this interesting fruit.

Kayam, *Inocarpus edulis* Forst. Leguminosæ. (Plate VIII.) A large spreading tree, leaves oblong, entire, with short petioles,

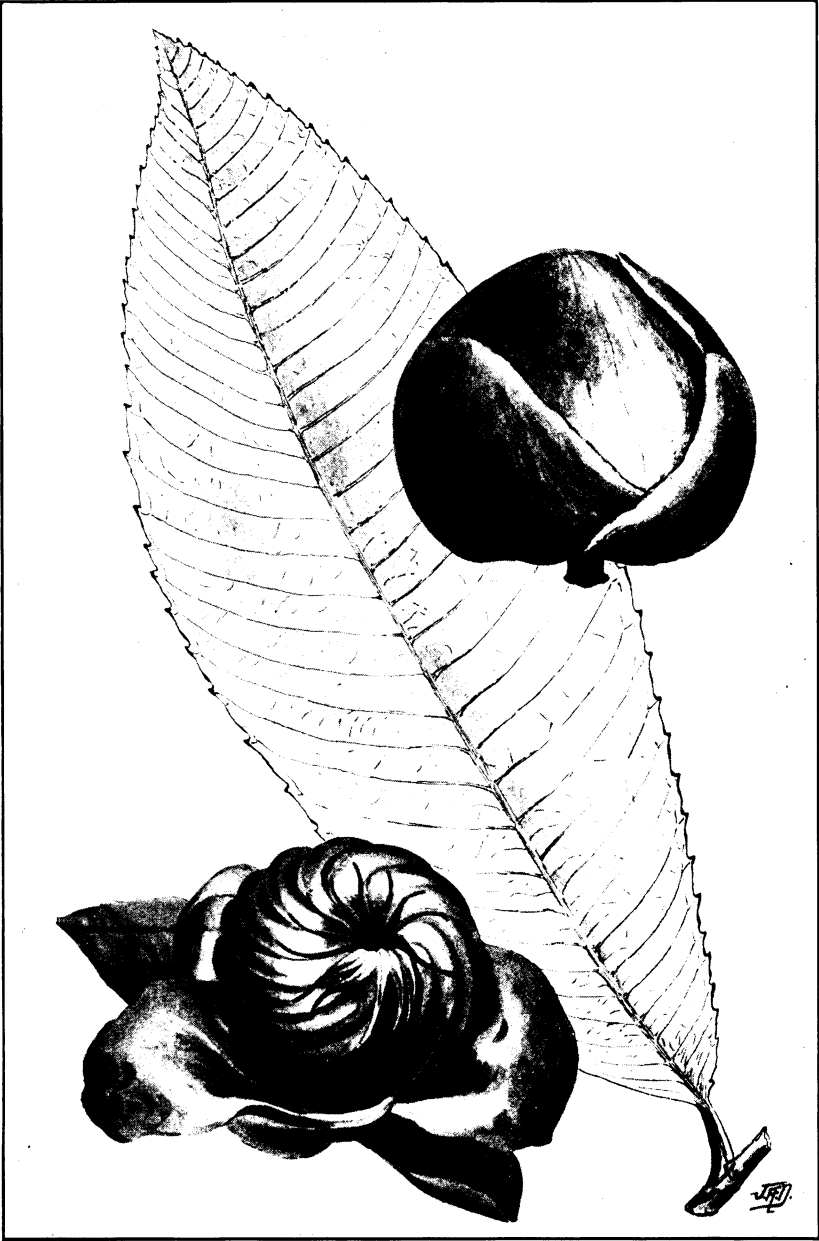


PLATE VI.—KAMBOJ (*Dillenia speciosa* Gilg.)—FRUITS TWO-THIRDS, LEAF ONE-THIRD, NATURAL SIZE.

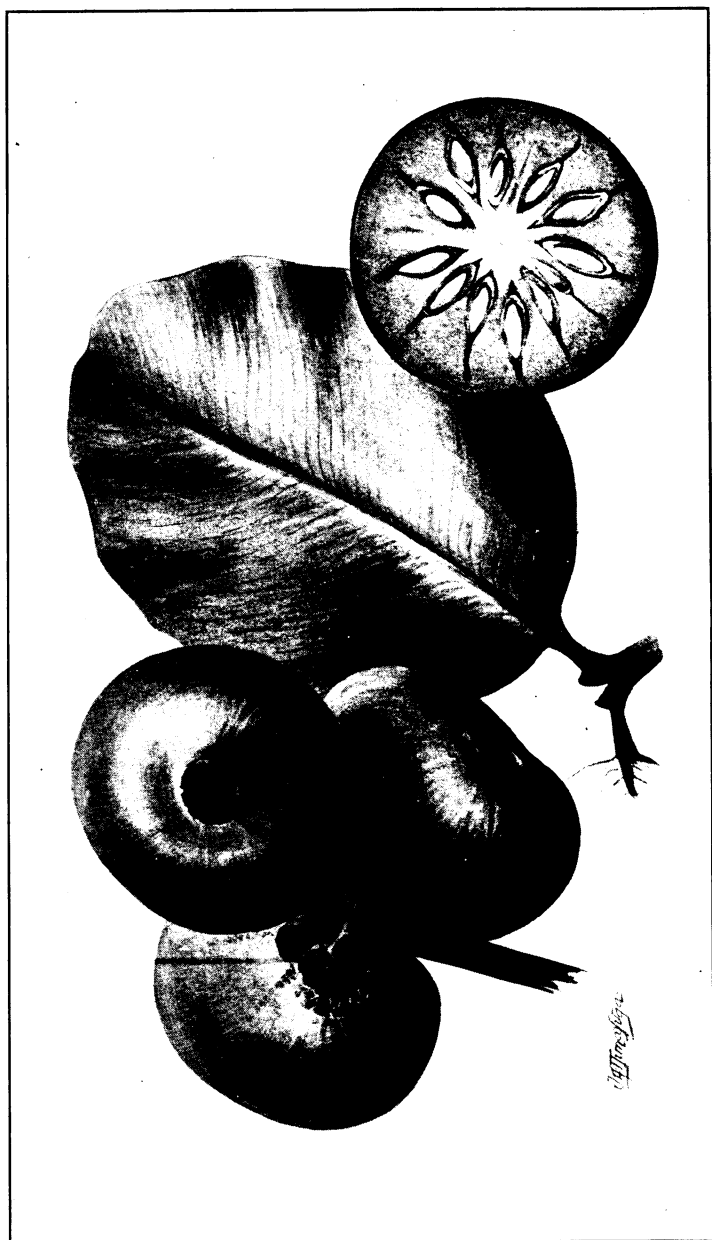


PLATE VII.—LIBAS (*Garcinia vidalii*, Merrill)—FRUIT ABOUT FOUR-FIFTHS, LEAF ABOUT TWO-THIRDS, NATURAL SIZE.

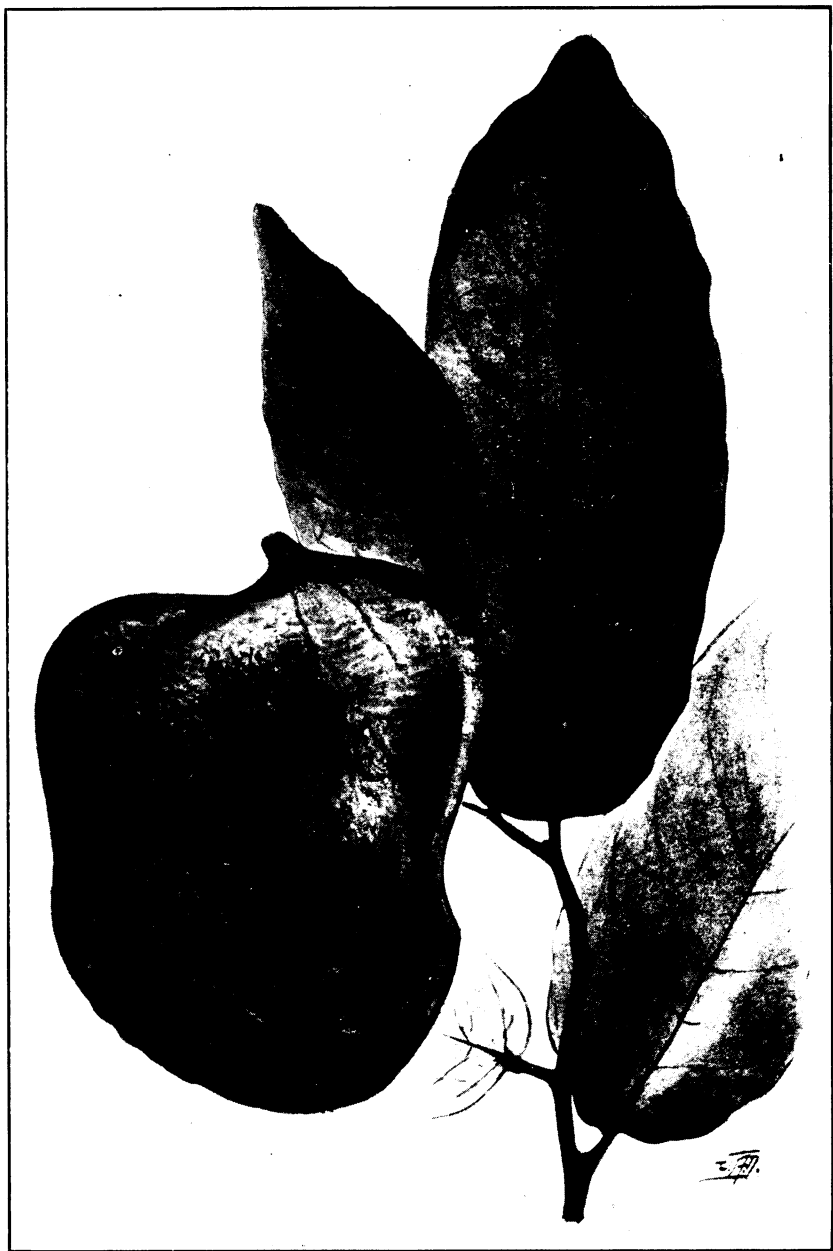


PLATE VIII.—KAYAM (*Inocarpus edulis* Forst.)—FRUIT NATURAL SIZE, TWIG AND LEAVES ONE-HALF NATURAL SIZE.

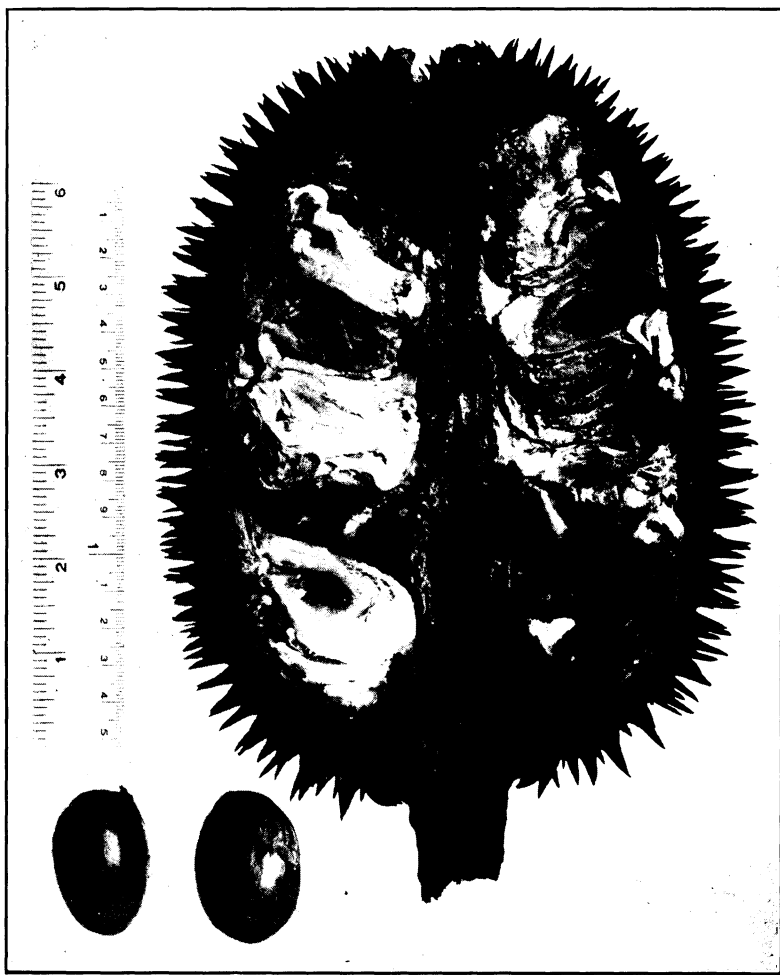


PLATE IX.--HALF-SECTION, DURIAN FRUIT, JOLO VARIETY. (21 by 16 centimeters.)

(Photo by O. W. Barrett.)

sparingly distributed in Mindanao and the Visayas. The fruit consists of a short, fibrous pod, 75 millimeters long, 60 millimeters broad and 34 millimeters thick, reniform, flattened, containing a large bean. Fullgrown but not quite mature fruits of the Kayam were obtained in Talisayan, the only place where it was seen by the writer. The fruits are roasted or boiled, and eaten, and in some parts of Polynesia and Malaysia are an important staple of food. Aside from its culinary value the Kayam makes a very desirable ornamental shade tree.

Durian, *Durio zibethinus* Lam. Sterculiaceæ. (Plate IX.) A very large tree, sometimes attaining a height of 30 meters, with alternate, ovate, oblong, acuminate leaves, entire, greenish above, silvery beneath. The flowers are produced in a cluster from the bare twigs or branches, the fruit is roundish or oblong and sometimes exceeds 3 kilos in weight, the thick horny rind being covered with hard spines about 12 millimeters long. On ripening, the fruit turns a yellowish gray and splits open into five parts from the apex, dividing the compartments containing the flesh and seeds. The flesh is whitish, buttery, melting, sweet, rich and very aromatic and separates readily from the woody "shell" and the seeds. Each compartment contains from one to four large seeds. To a seasoned Durian eater this fruit may be "worth a voyage to the East," to quote Wallace, but to the novice it is nearly always nauseous and offensive. To the writer garlic seemed to be its most dominant flavor.

The Durian is quite well known in horticultural literature but its cultivation has never been greatly extended beyond its native habitat. It is found in many places in Mindanao and is particularly abundant from Davao to the lake region of Agusan Valley and to a somewhat less extent in the northern part of Agusan. It also occurs in the Sulu Archipelago.

The Durian has hitherto never been successfully introduced in the Philippines north of Mindanao.

Trees and plants require certain climatic conditions in order to succeed, such as a certain degree of heat, light, rain and humidity, not to speak of soil requirements, and without which the plants would fail. It is not believed that the fruits described above will succeed in all parts of the Philippines but they will undoubtedly grow in many sections of the Archipelago to which they are now foreign.

SOME NEEDED NAME STANDARDS.

By O. W. BARRETT,
Chief, Division of Horticulture.

In the matter of stopping the usage of undesirable words prevention greatly excels attempted cure. Horticulturists in general regret that prompter action was not taken in regard to some words which have now gained so strong a foothold in the English language that it will be almost impossible to eradicate them. Botanical nomenclature is necessarily a more or less confused affair, but that is a matter for scientists themselves to worry over; whereas the terms and names in daily use in the line of horticulture, and for that matter in general agriculture, are words used by the majority of people. Here lies an interesting fact in the sociological, or rather the psychological, side of the question: we are always prone to associate one word with others which resemble it in sound or appearance, and by that association of ideas much good or ill may befall the object or word in question.

While it is true that there are plenty of cases of splendid profits being made, sometimes without a substantial reason therefor, through the fortuitous employment of a word or "catchy" phrase, there are probably just as many cases to the contrary. The writer has in mind, for instance, the case of a very promising industry that was said to have been ruined by the inadvertent use of the word "tubercle" instead of "tuber:" one can readily see that for a company to use, even accidentally, a word which is so frequently associated with a certain serious disease is to court disaster—even if we blame the result on phthisiphobia.

The following cases of misspelling, misapplication, and misuse of more or less good synonyms are worthy of interest.

Coconut.—Fortunately in the Philippines there is practically no need to warn the public against the old-fashioned spelling "cocoanut." The British forms of the word, "coco-nut" and cocoa-nut, should be discontinued as soon as possible, since strictly speaking, the object is a *fruit* just as much as a nut, and since

it is now such a common and well-known article there is no excuse for inserting the hyphen any longer. By the same token *copra* is the correct name for dried coconut "meat;" the addition of "h" (British system) or "x" (Spanish style) is neither decorative nor useful.

Cacao.—This refers not only to the tree itself but to the seeds produced therefrom. The term "*cocoa*" should be applied only to the product manufactured from the seeds—a trade term, like chocolate. By the way, the final vowel in "*cocoa*" is interesting as being one of the very few cases of an absolutely useless vowel in English; the original suffixion of the "a" was possibly excusable to distinguish that word from the six or eight other disyllables using "c," "o," and "a" in various combinations.

Avocado.—Objection to this word is gradually dying down, but, for some unknown reason, there still lingers in the minds of thousands of people an apparent preference for the hideous name "alligator pear;" this is probably due, however, to the plebian shrinking from any foreign-sounding word, especially if it has more than three syllables. It is said that the first use of the abominable epithet was by one Jack Tar who had been allowed shore leave somewhere in Central America where the days are not alone in being hot, where alligators make lasting impressions, and where some of the people still call the fruit "ahuacate," after the old Aztec "ahwacatl." Yet because one tired tongue refused to encompass the full measure of the really euphonious *avocado* is no reason why a perfectly good fruit, which ought long ago to have been exceedingly popular, should continue to struggle under such an opprobrious name. By the same token, many of the avocado types have no more resemblance to a pear than to a plum or pomegranate either in color or shape, to say nothing of the interior. To illustrate the obstinate attitude of the retail merchant, the writer recollects a case in Washington, District of Columbia, where the disgusting sign "Fresh Alligator Pears Today" was flaunted in the people's face, year after year, although the proprietor admitted that most of the purchasers of the fruit asked for *avocados*.

Mango.—The plural of this word is properly written without an "e." There is no good reason for adding a useless "e" to the other analogous foreign words which would not, when at home, so to speak, be given such a decoration, viz, tomato, potato, pomelo, chico, baúno, and, of course, avocado.

Pomelo.—This good old word has been discountenanced in most parts of the United States and a rather weird and quite

unreasonable substitute has been upheld, even by a few horticulturists. This substitute flourishes as "grapefruit," "grape-fruit," and "grape fruit." There are two theories anent the origin of this pseudonym: a gentleman at the Boston docks, coming upon a sample package of pomelos from the West Indies, and being quite unacquainted with the fruits, tested one and not having in mind just then anything else with which to compare the fruit declared that it reminded him of *grapes* (presumably of the Frost variety). The other and perhaps more reasonable theory is based upon a tourist's remark in passing some pomelo trees for the first time in the Tropics: noting that the fruits were sometimes clustered together near the ends of the branches he innocently opined that in that character they reminded him of *grapes*. The flavor, however, is so unlike that of any grape and the clustering habit of the fruit is so inconstant and so unfamiliar to 99 per cent of the users of the fruit, that it is strange if there is not a twinge of conscience in the mind of every person applying that false name to one of the best citrus fruits the world has ever seen—and the one which has made the most money for its growers, with the exception of the orange, perhaps, since the two species left their ancient home in India and the Far East.

Chico.—This excellent Tropical American fruit has traveled under several names, such as "naseberry," "sapodilla," "chico zapote," and others; but since it is not a berry nor any kind of a zapote, let us adopt the convenient little name which even Mrs. Grundy should have no difficulty with—except that it sounds "foreign" and therefore *might* have a meaning (sic) less nice than its flavor.

Yautia.—This good old Arawak word originally meant "place of the Hutia," or so-called Spiny Rat of the Antilles. This tuber vegetable is supposed to be the very oldest crop cultivated by man; and we can imagine the savages of twenty thousand years ago being obliged to choose a word which would clearly signify that object which was always to be found in the places frequented by their common game animal, the now early extinct Hutia. This plant has been called "coco," "eddoes," "otó," and "macal" in various countries of Tropical America. Worse than having a number of names is the fact that the yautías were for many years confused even by botanists with the *taros* which belong to quite another genus of plants with *peltate* leaves instead of arrow-shaped.

It will be an interesting question to note whether it will be

possible to accustom the Filipino planters to the use of the word before they get the idea settled in their minds that it is only a kind of "gabi"—which it resembles, of course, in habit.

Feijoa.—The name of this new fruit is to be spelled in English as in Latin but the Portuguese pronunciation (fay-zhó-a) is to be given it out of honor to Snr. Feijoa, a Brazilian gentleman, after whom it is named. This fruit will be very widely known, we believe, within a few years on account of its remarkably strong perfume and fine flavor, and now is the time to correct the spelling and pronunciation of the name.

Cherimoya.—This Central American fruit is now successfully introduced into the Philippines in the form of several varieties and even hybrids between *Anona cherimolia* and other species of *Anona*, and it is rapidly becoming very popular in California. It is also spelled Chirimoya, Cherimolia, and Cherimoyer, and, especially in California is often confused with the custardapple.

Custardapple.—This, not being an apple in either shape, size, color, or flavor, should either be written as one word, or better still a new word should be decided upon to take the place of the rather awkward and long name it now bears. The once fairly common West India name of "Bullock's Heart" has fortunately been dropped.

Sugarapple.—This also should be written as one word. It is also called Sweetsop in many British colonies. A new name is needed.

Mamon.—This fruit has also suffered under the names "Alligator Apple," "Monkey Apple," and "Pond Apple," but since it has nothing to do with any of the indicated objects it should be given a square deal.

Hevi.—This fruit has passed under the name of Otaheite (or Tahiti) Apple, or Vi, but the old Polynesian name used in its own home, so to speak, is much to be preferred. It is properly known to botanists as *Spondias cytherea* (*nec S. dulcis*).

Roselle.—This promising new vegetable-fruit came near being called "Jamaica Sorrel" a few years ago; the principal reason for such a name was the sour taste of the leaves and the so-called fruits. By the way, it has recently been misquoted, purposely or otherwise, as "Grosella," which is translated currant.

Baúno.—This new fruit in its very brief period of existence before the horticultural world has already been called Balun, Balono, Bayuno, and Bayono; but, there being little choice among these names, we should follow the native name mentioned in the original description by Mr. Robinson, of the Bureau of Science.

Papaya.—This word is probably Polynesian in origin and, therefore, of very easy pronunciation. It is not a “tree melon” and since another fruit (*Asimina triloba*), quite unrelated, is also called “Pawpaw” the latter word should be dropped as a synonym.

Cassava.—While there may be some reason for using the old Brazilian word “manioc,” or “mandioca” for this crop, there is no good excuse for the Spanish-American “yuca,” nor the fortunately rather rare British East Indian “tapioca.” It is pardonable to sometimes use the commercial product when figuratively speaking of a raw material crop but we should no more speak of a “tapioca plantation” than of a flour field.

Soursop.—Unfortunately there seems to be no escape from using this objectionable name for a perfectly good fruit. It is known as “Araticú” in Brazil, as “Guanábano” in Spanish America, and “Guyabano,” etc., in the Philippines, but since we are dealing with English words we must fall back upon soursop for *Anona muricata*.

Yambo.—This fruit certainly does smell like roses and taste as roses ought to taste, but it is not an apple in any sense of the word and, therefore, we should relinquish the beautiful but inappropriate name “roseapple.” “Jamrosade” is also too much of a good thing; but yambo is the old name for this excellent fruit—which, we hope, will soon be much more popular here.

Mandarin.—Let us not use the word “tangerine” any longer. Tangiers, or as we should say, Tanger, is the adopted home of many good citrus fruits but it is hardly fair that we should accredit that city with the so-called “kid glove” type of oranges (*Citrus nobilis*) which was quite certainly brought out of southern China where mandarins have raised them for centuries.

Maize.—Out of deference to the Spanish “maís” and our British neighbors who more or less correctly regard several other grains as corn, let us adhere firmly to the old (pre-Columbian Arawak “mahiz”) correct name by which it is known practically everywhere outside of the United States; at this late date it would be useless to attempt to substitute the correct for the popular term there, but we are just in time here in the Philippines to start right.

CORN DEMONSTRATIONS IN THE PHILIPPINES.

By BENJ. P. LUKENS, *Chief, Division of Statistics.*

The Bureau of Education is carrying on a constant and consistent campaign for the betterment of the food supply of the Philippines. Its object is twofold: the improvement in quality and variety, and the increase in quantity. The severe drought of the past year attended by a great shortage in the rice crop showed clearly the danger to the people of depending too much on one sole crop, and especially a crop so sensitive to weather conditions as rice.

Commencing in June of this year the Bureau began an energetic and practical effort to interest the people in maize and to prove to them that maize as an article of diet was more nutritious than rice and as a plant was hardier and more easily raised. It was not the desire to supplant rice but to supplement it as a food and to utilize in corn culture land which now lies waste or untilled.

Realizing that the Filipinos made very little use of maize as a human food largely because they understood only one or two primitive ways of preparing it, the Bureau decided to popularize it by holding "Corn Demonstrations" in every municipality and school district in the Islands—more than one thousand in all. These demonstrations were to consist of public gatherings on the school grounds and in school buildings where the maize would be put through all the processes of preparation and cooking under the very eyes of the people and they would be given an opportunity to eat the various dishes thus prepared. Two of these "corn demonstrations" were held near Manila and a brief description of them will give a better idea of what the plan means.

On August 24 the first one was held at Pasig, Rizal Province. Under the supervision of the division superintendent of schools, Mr. Russel Trace, and all of the American and Filipino teachers of the provincial school, the grounds around the school building

were converted into a series of ornamental corn booths made almost entirely of corn stalks, leaves and ears, and decorated with festoons of thousands of grains strung together on threads. The words "Corn is King," executed in cornstalks, stood out prominently over the entrance to one of the buildings. Each booth was devoted to only one phase of the work and was under the charge of one or more demonstrators. The chief object was to show how many simple yet palatable kinds of food could be prepared from common corn. The following dishes were served at the various booths: hominy, mush, hoe cake, johnny cake, corn with tomatoes, stewed corn, fried corn, and corn-starch pudding. Three thousand six hundred services of food were made to more than one thousand people. Recipes for the different dishes were distributed in Tagalog and English. One interesting feature was the singing of specially prepared corn music written and adapted for the occasion by one of the teachers. Exhibits were made of cornstalks with two ears, ears in husk, ears husked, corn-leaf fodder, seed testing, and the making of hominy. A modern hand grist mill and a native hand stone mill were in operation side by side, and nearby a small corn sheller. The actual outlay of cash was ₱67 for materials.

The demonstration at Malabon was held two weeks later on September 7. By reason of the publicity given to the Pasig demonstration and its pronounced success it was possible to interest more people in the Malabon display. The crowd of visitors numbered more than five thousand, among whom were the acting Governor-General, several Bureau chiefs and others high in authority. Under the leadership of Mr. J. B. Graham, supervisor of the primary schools, Mrs. M. A. Keeney, principal of the intermediate schools, and the Filipino teachers in both the primary and intermediate schools, the demonstration work was carried into very elaborate detail. In the eight booths located on the grounds of the intermediate school sixteen different corn dishes were served. These were classified in the form of breakfast foods, soups, entrees, meats, vegetables, salads, desserts, and corn coffee. The entire list included the following: mush, hominy, corn pone, hoe cake, pan cake, corn soup, corn oysters, tamales, corn with meat, corn bread, stewed corn, fried corn, corn with tomatoes, corn salad, corn-starch pudding, and corn coffee. At the entrance to the ground was an arch bearing the legend "Corn City." This arch and its letters were prepared from corn stalks, leaves, ears, and grains. The booths were also decorated in a similar manner. A special feature of the occa-

sion was a "Queen of Corn" whose horn of plenty was filled with corn, whose scepter was corn, whose crown was of golden corn, whose robe was gorgeously embroidered with pearls of corn, and above whose head was an elaborate design of the seal of the Philippine Islands wrought in various colored grains of corn. Displays were made of the proper methods of selecting seed, planting and cultivating. Stalks with two ears were exhibited and hand machines were in operation showing the modern means of shelling and grinding corn.

More than a hundred of these corn demonstrations have already been held in different parts of the Philippines but full reports have not yet been received. They will all follow the same general lines as those of Pasig and Malabon. It is hoped to convince the public that maize is a most desirable food from the standpoint of economy, nutritive qualities and hardiness under adverse weather conditions.

SOME PHILIPPINE BANANA RECIPES.

By Mrs. O. W. BARRETT.

With the desire of enlarging our list of vegetable and fruit dishes the following somewhat unusual recipes are submitted:

BAKED BANANAS.

Baked bananas; as a desert dish.—In an enamelled dish place thin lengthwise slices of “Sabá,” covering with a thick sprinkling of brown sugar dusted with a bit of cinnamon; add one-fourth teaspoonful of butter for each slice. Bake till the “Sabá” is translucent and sirup has formed from the “Sabá” juice and sugar.

Baked bananas; as a vegetable.—The “Latundan” and “Sabá” are best for this; only perfectly ripe fruit should be used. The unpeeled fruit should be placed in an enamelled dish and baked just in time to be served hot; send to the table in the skin, as hot as possible, adding a bit of butter, lemon, or salt, as desired. “Latundans” require 10 minutes, “Sabás” about 20 minutes, in a hot oven. Do not allow fruit to remain in the skin long after being baked as the skin causes the fruit to become slightly acrid.

FRIED BANANAS.

Select perfectly ripened “Sabás.” Allow 1 teaspoon butter for three small fruits; fry thin slices until slightly browned, dishing at once. Too long cooking produces a “watery” condition. Lemon juice may be added at the table. “Latundans” are good fried but should be cut in thick slices.

BANANAS IN SOUP.

In the West Indies slightly acid bananas similar to our “Latundan” are sliced and added to soup just at the moment of serving, being especially good in tomato soup.

BOILED BANANAS.

Boil in the skin till soft several "Sabás." Peel and add salt, pepper, and butter, and serve as a separate vegetable course.

Boil in the skin till soft several "Sabás." Peel, cut in 2-inch lengths, and, at serving, add to a beef-stew, pot-roast, or corned-beef-and-cabbage stew.

BANANA SALAD.

The "Lacatan," "Bungulan," and "Latundan" are best for salad purposes. Always prepare with a silver knife, and always scrape from the fruit the fibrous strips of peel that often cling to the fruit. Besides the well-known combinations of bananas and apples, nuts, or celery, sliced bananas are especially good served with chopped figs, dates, or white cherries mixed with the regulation mayonnaise dressing.

BANANA BUD.

Remove the purple leaf-bracts from the outside of the banana bud (from the tip of the bunch). Boil this white heart about 30 minutes. Cut lengthwise; serve hot with spiced butter sauce, or cold with salad dressing.

The unopened flowers from several buds may be removed from the bracts and cooked like string beans, or mongo sprouts.

BANANA PUDDING.

Slice ripe "Lacatan" or "Latundan" bananas in a baking dish adding a tablespoon of water and a teaspoon of sugar for each banana; bake about 20 minutes in a moderate oven. Add well-beaten whites of two or three eggs sweetened with a tablespoon of sugar. Return to oven for 5 minutes. Serve cold.

BANANA BREAD PUDDING.

In a baking dish place alternate layers of buttered bread and sliced "Latundan" bananas adding 3 eggs well beaten with 3 tablespoons white sugar and sufficient milk to cover. Bake 20 minutes in a moderate oven. Good served hot or cold—with a tart jelly or hot chocolate sauce.

CURRENT NOTES ¹—NOVEMBER.

UTILIZATION OF SISAL WASTE.

Ever since the invention and successful operation of fiber-extracting machines, the economic utilization of sisal and henequén waste has been the subject of extensive tests and experiments by scientists. The results so far obtained show that this waste may be economically utilized for the following purposes: Manufacture of industrial alcohol, as a fertilizer, and as a stock feed.

In a current note in the September issue of THE PHILIPPINE AGRICULTURAL REVIEW a brief résumé was given of the results of M. D. Herelle's and other chemists' experiments in the manufacture of alcohol from henequén waste which seemed to indicate that this industry can be made remunerative in spite of the difficulties encountered in fermenting the waste. The results obtained from Mr. William McGeorge's experiments in sisal waste in Hawaii, however, are not as encouraging as the former. In his report, published in Press Bulletin No. 35 of the Hawaii Agricultural Experiment Station, dated June 12, 1912, Mr. McGeorge sums up the results of his experiments as follows:

In view of the comparatively small quantity of waste accruing at present at the Hawaii plantations and the very low sugar content of sisal leaves, it is not deemed a profitable undertaking to utilize the sisal waste of Hawaii for making alcohol, taking into consideration the difficulties to be overcome in the fermentation. Several fermentations were made by the author in this laboratory, and while an alcoholic fermentation was obtained by using ordinary compressed yeast, the yield was very poor and indicated the difficulties to be overcome. * * *

In our analyses the sugar content of the fresh leaf varied from 2 to 7 per cent, making an average of 4.5 per cent, which theoretically would yield about 26 liters (or 6.5 gallons) absolute alcohol per ton of leaves. It is hardly conceivable that with such a sugar content this could be made a remunerative industry with the waste at hand, and even with the large quantities of waste at Yucatan it would require a rather efficient method.

¹Original notes prepared by various members of the Bureau of Agriculture.

As to the utilization of sisal waste as a fertilizer, the Press Bulletin referred to above mentions the belief that this is the best economic utilization that could be made of the waste at the present time. It states that the value of the waste for fertilizer purposes is estimated at \$6 a ton and is consequently greater than the value of the fermentable substance for alcohol production. Herbert and Heim are also mentioned as having reached the above conclusion.

The utilization of sisal and henequén waste in the fresh form as stock feed is also reported to have given fairly satisfactory results in some countries. The waste contains a fairly high percentage of sugar from which it derives its nutritive value, and it is believed it will give very satisfactory results especially when it is used in the dry form and mixed with other feeds. (*M. M. Saleeby.*)

CORN AND RICE ROTATION.

The farmer who does not keep his land busy is not making the best use of his capital. If it is possible to grow three crops on land and only one or two are taken, the farmer has lost the value of the extra crop if he fails to take it. The farmers in those sections where irrigation water is available could, if they manage their farms properly, take off one crop of corn in addition to two crops of palay.

The following procedure is suggested. Starting the first of April, the rice field may be broken and planted to corn. One hundred days should be sufficient to mature the corn and remove it from the field. The seedbed for transplanting the field to rice should be planted by June 20, then if the corn is removed by July 10 the field should be prepared and transplanted by August 1. One hundred and fifty days from sowing the palay seed to harvest should bring us to November 20. Then by having the seedbed prepared by October 20 this field should be transplanted again by December 1. By March 20 this crop should be out of the way and still have sufficient margin for planting to corn again by April 1. This plan has several things to recommend it.

First. Corn planted in April will produce the best crop of the year, provided, of course, that irrigation water is used.

Second. Palay transplanted August 1 will have the best season for its development and will ripen in good weather. The second crop grown as indicated would develop better than if planted later because the hot sunshine retards development.

Third. Cowpeas or mungos could be planted with the corn and thus improve the land. (*C. M. Conner.*)

PILI NUTS.

During the last few years the world has come to realize that nuts as food have not been given due credit; but in the United States at least there is a sort of nut crusade on at present. Possibly the exquisitely flavored new varieties of pecans which are just beginning to become well known throughout that country are largely responsible for this renewed interest.

There is no question but that the Pili will soon be a common and popular nut in confectionery, at least, in the Eastern States. A recent shipment (part of the million-peso cargo of the steamer *Shimosa*) of some 3,500 bags was made from Manila direct to New York. Several large shipments have also been sent to San Francisco from here. Unfortunately little seems to be known regarding the best conditions under which the three or four commercial kinds of Pili nuts are produced. The principal localities from which they are now obtained are the Albay Peninsula and the Province of Tayabas.

According to Mr. E. D. Merrill, botanist of the Bureau of Science, there is some confusion at present regarding the scientific nomenclature of the Philippine Pilis. They are all, of course, of the genus *Canarium* of the Burseraceæ, a family noted for its resins and gums. The rather valuable genuine "gum elemi" of the Philippines is nothing but Pili resin; it is a brilliant white, almost solid, pitch-like substance, with a pleasant, aromatic, terebinthine odor; it is used in pharmacy, its stimulating properties being of good use in ointments, plasters, etc.

The texture of the kernel is almost ideal; it is exceedingly light without being spongy, brittle without being hard, and highly flavored without being oily. It is so easily digested that a kind of infant food is said to be prepared from it, the blanched kernels probably being pressed to remove excess of oil and then ground. The blanched nuts, browned and salted, are fully equal to either the "Paradise" or Brizil nuts and of much better texture than almonds; they may also be eaten raw. Even the pulpy husk of thoroughly ripe nuts is eaten by the Filipinos in some districts.

It appears that nowhere in the Philippines is the Pili actually cultivated, though in the Moluccas a species, which may also occur in Mindanao (*C. commune*), is actually under cultivation.

Some ₱20,000 worth of Pili nuts were exported from Manila in the first quarter of the present fiscal year. (*O. W. Barrett.*)

CARDAMONS.

The "Tropical Agriculturist" for August contains two interesting papers on cardamon culture. It is considered that this spice may have been used in India at a remote period and cardamons were known as a Singhalese product about 1154.

Cardamons are the product of *Elettaria cardamomum* Maton, indigenous to Ceylon and Malabar, where it grows wild at an altitude of 750 to 1,500 meters and where it also is cultivated; Siam, China, Malaysia, Madagascar, and West Africa also produce cardamons.

The cardamon succeeds best in rich loamy soil in well sheltered, moist localities with a mean annual temperature of 72° F. and a rainfall of about 3,000 millimeters and is grown under partial shade. The plants are set 210 centimeters apart each way. After the plantation comes into bearing the crop is gathered from August to the following April in successive pickings, the annual yield sometimes totaling 225 to 235 kilos per hectare. Ceylon produced in 1910 182,697 kilos and India 290,550 kilos of cardamons of which 40 per cent went to the United Kingdom. Sweden, Norway, Russia, and parts of Germany are among the principal users of cardamon for culinary purposes and the demand for the spice in the United States and Turkey is growing.

Because of the nature of the product and its comparatively limited demand, which is easily oversupplied, the culture of cardamons can not become an industry of great magnitude. However, in a limited way, this spice would be likely to become profitable in many parts of the Visayas south of the typhoon belt and in Mindanao if it were introduced and rightly handled. (*P. J. Wester.*)

RATE OF PLANTING CORN.

One of the most serious drawbacks to the production of corn on a profitable basis, in at least a part of the Island of Luzon, is growing it entirely too thickly upon the ground. Not even the famous "Corn belt" of the United States could produce corn if the fields had as many stalks per unit of ground as is found here. With the prevailing method of planting there, in hills of three stalks each, about 105 centimeters apart each way, a hectare of land would have growing on it about 18,000 stalks. Not infrequently it has been found that reducing this number of stalks to two in a hill, or 12,000 per hectare, will actually increase the yield of grain. It is nothing uncommon in parts of Luzon to

see the stalks so close together that there must be from 40,000 to 50,000 per hectare. It is no wonder the yield is small. Indeed, there is no possibility of it being anything else.

A little field was observed in Batangas Province the latter part of August, which had had some fertilizer applied to it before the corn was planted, which was on July 10. Even with this added encouragement there would be practically no corn produced, because there were about three times as many stalks on the field as the best of corn land would be able to support and make the proper yield of grain. The corn, aided by the stimulus of the fertilizer, had made tremendous plant growth, but was not able to make ears worth while. Just across the road, without fertilizer, and with only about one-fourth as many stalks for the same unit of area, was a good crop of corn.

The Filipino farmer wishing to grow corn can not be urged too strongly not to plant thickly. He will be the gainer in two ways: First, by using less seed, and second, by being very much more certain of a crop. (*H. T. Nielsen.*)

ONE BARRIO THAT IS FEEDING TWO MUNICIPALITIES.

In October, 1911, Mr. Ross Mathews was placed in charge of four stallions in the north of Catanduanes Island with station in the barrio of Bagamanoc, municipality of Viga. The drought had been so severe even at that early date that the people of the barrio were compelled to secure most of their vegetables from the other barrios of Viga.

Shortly after his arrival there Mr. Mathews brought the people together and through the influence of the councilmen and headmen the majority were prevailed upon to plant as much corn as possible. The result was more than could have been expected as this small barrio is able to sell large quantities of corn to the two municipalities of Pandan and Viga, aside from the amount traded with the traveling merchants that come from Lagonoy with fish and from Tiwi with pottery. The writer took occasion on his last visit to Bagamanoc to personally visit a great many homes and found in all a goodly supply of corn. Corn is practically the only cereal food used by the people. Where in other places they are pounding rice here they pound their corn and after sifting it cook it as they do rice. Some also is popped in a skillet and more yet is used by merely roasting it on the cob. The barrio of Bagamanoc was carried over the hard months caused by the drought by its abundant supply of corn all through the initiative of one man. The people have learned that rice is not an absolute necessity but can be replaced by other cereals.

Considerable damage is being done to the corn in the milk by the numerous rats. Entire patches were seen absolutely ruined. These were generally in sections surrounded by scrub growths providing a safe hiding place for the rodents. (E. H. Koert.)

MAIZE IN MULTIFARIOUS WAYS.

Now that the Philippines are really entering upon a new era of maize culture, it is well for us to look about and see how other countries regard this food plant. To go into a thorough discussion of this subject would require many pages, but a few of the less common uses may be worthy of mention.

Probably no country, outside of the European countries and the United States, uses a greater proportion of maize in its diet than Mexico. There the sound of tortilla making is heard throughout the land; really, during the first half of the day, the sounds made patting out the dough, i. e., the finely ground paste of the softened maize kernels, is heard in every Mexican pueblo; and by the same token, this tortilla is the commonest food of the people not only in the Mesa but also in the Tierra Caliente. Notwithstanding the belief that too much maize in a hot climate is not "good for the blood," it is the *pièce de résistance* of all classes of people even in the hottest districts of Mexico and Central America. After four years' experience with many varieties of tortillas eaten under all sorts of conditions—up at elevations of 3,000 meters and down in the suffocating jungles of the coast forest area—the writer has no hesitation in pronouncing the tortilla the best form of maize food, everything considered, that the world has ever used thus far. The appetizing taste of these thin, thoroughly cooked and very digestible cakes is very frequently varied by the addition of other material, such as beans, and spices such as "chile" (peppers); then, too, the varieties of maize, of course, must be considered; in fact no two batches of tortillas ever taste exactly alike since the degree of heat with which they are cooked, the amount of lime and salt used in the soaking or boiling waters, the degree of fineness of the paste, the thoroughness with which the hulls are removed—such apparently insignificant matters—all contribute to this splendid diversity of taste, smell, and even appearance.

Maize also enters into tamales, though to a lesser extent, and thereby hangs another pleasant tale.

Some of the less well-known maize foods are those of the Basques of northern Spain; these people use a moderate amount of maize and employ three or four distinct methods of preparation, some of which resemble the *gofio* of the Canary Islands.

If someone familiar with the uses of maize in northern Spain would be good enough to write up for publication his knowledge of the matter, the Philippine public would be greatly obliged, in my opinion.

Gofio is a common food in the Canaries and is made by roasting and then grinding the maize kernels. There are, of course, many varieties, some of which include wheat and barley meal, although the best gofio should have about 90 per cent of the maize meal. This food, which is said to be one of the best forms after the tortilla, has recently been introduced into Cuba, Porto Rico and the other parts of tropical America where the Canary Islanders have made their homes.

In Mozambique the writer has been obliged to fall back sometimes upon a Kafir ration when safari provisions were not in evidence; this food is a meal composed of ground Kafir corn, maize, and peanuts in about equal proportions; ground red peppers and sometimes ginger may be added to offset the rather indigestible quality of the mixture. It is carried in the basket-work knapsacks of the natives when traveling long distances overland and a handful of the food is considered sufficient for one full meal. The grains are more or less parched before grinding. If one could be quite sure of the cleanness of the substance it would be a fairly appetizing sort of emergency ration. Like gofio it may, of course, be mixed with hot or even cold water or milk to form a sort of paste or dough; this in turn could be fried or roasted as tortillas or cakes. (*O. W. Barrett.*)

THE WORLD'S BEST POMELO.

One of the most important recent introductions of the Bureau of Agriculture is that of the Siamese seedless pomelo, obtained from one of the Bureau's correspondents in Bangkok, Siam. Nearly everyone engaged in raising citrus fruit throughout the world has heard of this wonderful citrus fruit in Siam, and several attempts have been made heretofore to introduce it into other countries; however, largely on account of the inaccessibility of the district in which this particular variety exists, all efforts so far as we know, with the present exception, have failed.

Last April the writer had the pleasure of examining this famous fruit, and both in appearance and flavor the specimens were fully up to the high mark set by previous descriptions. This variety is probably the most free from seeds of any of the pomelos, or so-called "grapefruits," which are, of course, only varieties of pomelos. The shape, size and color of the fruit are also practically ideal.

After considerable correspondence the writer's efforts were rewarded on August 17 by the receipt of three mailing tins of budwood from Bangkok. On account of the packing material being somewhat too wet, a part of the budsticks had decayed en route; moreover, about half of the twenty-five buds which were inserted were killed by the very rainy weather which obtained at the time of the arrival of this material; several of the buds are certainly alive and two have started growing, thus making the introduction a success.

It is difficult to estimate the value of this fruit to the Philippines, but if the citrus industry develops here, as we hope it will, there is no question about this pomelo's taking the first rank in that group of citrus fruits. (*H. H. Boyle.*)

A NEW PHILIPPINE INDUSTRY.

In the December, 1911, issue of the REVIEW, the writer called attention to the possibilities of apiculture in the Philippines. Six colonies of Italian honeybees were ordered about the same time from Hawaii by the Bureau of Agriculture, and these arrived February 4 of this year on the U. S. Army Transport *Sheridan* on which they were placed January 13. The bees suffered considerably in transit, due evidently to faulty ventilation and only one hive contained 1,000 or more live bees on arrival. Two more had about 200 each, and one only about 100 bees; two colonies were dead. The five colonies were merged into two, but, notwithstanding this, they gradually died off till only one weak colony was left; this is slowly gaining in numbers now.

Undiscouraged by this result, some time ago, another order for six colonies was given to Mr. J. B. Thompson, in charge of the Guam experiment station. Mr. Thompson accompanied in person the five colonies that were sent to Manila and they arrived in good order August 1 on the U. S. Army Transport *Logan*; they are temporarily established at Singalong experiment station and seem to be pleased with their new home.

Apiculture, like most industries, had its inception and development in the Temperate Zone, yet it finds its best application in the Tropics and subtropics. Owing to the fact that the continued summer gives the insects the opportunity to work the entire year with no need of storing supplies for a long winter, the year's gain of honey and wax, if the apiary is well located, is far greater in the Tropics than in the Temperate Zone. While the writer holds out no such dazzling hopes to the would-be Philippine apiculturist, it is worthy of note that the world's record for honey production is held by the subtropical state of

Florida. The one hundred and three colonies of an apiarist there, known to the writer, averaged 135 kilograms of honey per colony one year, and one produced the astonishing amount of over 225 kilos. The finest flavored honey in the world is, by the way, produced by a tropical leguminous tree, the logwood, *Hæmatoxylon campecheanum*, recently introduced into the Philippines. In this connection it might be mentioned that the exportation of beeswax gathered in the woods from the wild bees is a not an inconsiderable item in the export products of Mindanao. (P. J. Wester.)

SOIL PREPARATION.

One of the prime essentials in the raising of crops is good preparation of the soil before the crop is planted. The desirability and advantage of this previous preparation is less noticeable on irrigated land, especially in rice growing, than where rainfall is depended upon for the water supply.

In a recent trip into Batangas Province, two pieces of upland rice were observed which illustrated the value of improving upon the present methods of soil preparation. In this trial one piece of land had been plowed deep and carefully with a "Luzon" plow, the other with a native plow. The rice on the deeply plowed ground was easily 50 per cent better in appearance than that on the piece prepared in the ordinary way. So pronounced was the difference in appearance, that the owner of the land declared he would do his future farming with plows of the "Luzon" type.

There can be no doubt that the use of the better plows would add greatly to the products of the Islands, even if no more land were brought under cultivation. Such increase would be still larger if the work stock were used in teams of two or even four animals, and the plowing be good and deep, 15 to 20 centimeters, and the further preparation needed consists of working the surface with disk and smoothing harrows until planting time. In the United States a farmer without a disk harrow is seriously handicapped in preparing land for any kind of crop.

Plowing, when done well, is an expensive operation: The use of the disk harrow is more economical for final preparation before seeding, and adds greatly to the farmers returns by diminishing the cost of production, and also increasing the size of the crops produced. This is one of the easiest and simplest methods by which the Filipino farmer can improve himself, and he should not be slow to avail himself of the method. (H. T. Nielsen.)

THE PRESENT RICE CROP.

From observations made along both lines of railroads leading out of Manila, the area of rice planted this season appears to be greater than ever before. So far the crop has not been damaged on account of weather conditions and the prospects for an abundant harvest are good. (C. M. Conner.)

THE BEGINNING OF THE NEW COPRA EPOCH.

At last the tide of public opinion is setting so strongly against the reprehensible methods of the Filipino copra maker that evidences are now to be found, by even the casual observer, which indicate that the day of scorched and rotten copra is passing.

It appears that there is a renewed interest in the abominable *tapahan*, or rather in the kind of fuel which should be used therein. The Philippine *tapahan* owner usually employs both the "cascaras," or shells, and the "bonote," or husk, as fuel for his fire (not to say *smoke-chamber*), the quality of some of the "bonote" being extremely poor, i. e., so green and wet that in burning it produces much steam and smoke though but little heat.

There is a movement on foot now—not emanating from this Bureau—with the object of inducing the small planter to use only shells in his *tapahan*. This idea is, of course, good so far as it goes, but the only way to prevent smoking the copra in the *tapahan* is to provide a metal, or possibly matting, sheet to slide underneath the floor or lattice-work supporting the copra, as advised in THE PHILIPPINE AGRICULTURAL REVIEW (May, 1912, p. 267). This could be kept under the copra while the smoke from the husks and shells is passing off by flues or some sort of a wide chimney at one end of the structure; as soon as the bed of clean coals is formed with practically no smoke rising therefrom, the sheet or tray may be withdrawn, thus exposing the copra to the direct heat of the coals. This process, of course, can not turn out absolutely smokeless copra, but it would in a large measure reduce that objectionable feature.

The most encouraging news in this connection, however, is the fact that in Laguna two plants have recently started with steam-heat dryers; this machine, planned by a Filipino planter, is a modification of the drier operated by the Bureau of Agriculture during the First Philippine Exposition. The sides of the drying ovens are properly made of wood instead of metal and the steam pipes are laid under each tier of trays instead

of being massed at the bottom. These plants are turning out A No. 1 copra in about ten or twelve hours from the charging of the trays; having arrived deplorably late in the Philippine economy they are, of course, running night and day now; two to do the work of 2,000! The steam pressure is kept low in order to keep the temperature down to about 50° or 60° (130° or 150° F.), i. e., to prevent releasing any of the oil in the copra. The boiler is of a simple type and the fuel is anything from wood to half-dried coconut husks. The principal point is that it works just as well during a rainy day as at any other time; and furthermore copra, which has been partly dried by *tapahans* in the vicinity and which is beginning to rot, can be saved—though, of course, not as A No. 1 material—by putting it in the driers for a few hours.

On a recent inspection of one of these plants the writer noted that a large proportion of the unhusked nuts that were being delivered to the factory were not only not cured but were even quite unripe and a considerable number were positively green: this spells a very considerable loss not only to the planter but also to the one who attempts to make good copra out of a raw material which must needs have a very low oil content as compared with that from cured, ripe nuts.

By the way, at least three firms in Manila seem to be contemplating the wholesale manufacture of copra driers for small or average-sized plantations; the Bureau of Agriculture has been consulted in each case and certain features have been advised and suggested which will, we believe, make for meliorism. (*O. W. Barrett.*)

THE CALIFORNIA NAVEL ORANGE IN THE PHILIPPINES.

Since the American occupation of the Philippines, several varieties of the citrus fruits cultivated in Florida and California have been imported into the Archipelago. However, many of those who have made these introductions have had more enthusiasm than knowledge about the subject and others have been little more than transients, with the result that their plant-introduction work has been lost and few introduced varieties have in consequence as yet fruited in the Philippines.

In February, 1910, Mrs. M. L. Sawyer, of Manila, imported several citrus trees from California, among which were some navel oranges. Doing poorly at first, the trees, after adjusting themselves to Philippine conditions, have made a very satisfactory

growth and one tree produced several fruits this year. The fruits ripened in September and a specimen was presented to the Bureau for testing. The transformation in the navel orange caused by its transportation to the Tropics is so great that few of its California friends would recognize it. It is of good size, the skin thin and "silky," and the flesh is juicy enough to satisfy the most exacting; the acidity of the California-grown fruit has here been changed to an almost excessive sweetness; with a trifle more sprightliness this Philippine-grown navel orange would be a fruit unsurpassed in quality. Budwood of the variety has been presented to the Bureau by Mrs. Sawyer and budded trees will be distributed in due time to applicants. (*P. J. Wester.*)

COOPERATIVE DEMONSTRATION WORK.

There are very many views as to the best manner of carrying on coöperative demonstration work. The conditions most certain to bring success are when a particular community becomes sufficiently interested in the improvement of farming to request aid in carrying on demonstration work. Another way that is very good, and practically sure of getting results, is to work a given community intensively. Four or more farmers, each of whom is naturally inclined to want to be considered as raising the best crops in the neighborhood, are selected, and each is encouraged to take up some coöperative work with the idea of making his position as the best farmer secure.

The various coöperators may all work on the same crop, each one attacking some special feature. The object is to secure a healthy rivalry in getting results. This class of coöperative work requires care and tact in arranging, but is not especially difficult. The writer once carried out such a coöperative test that was very successful. Cowpeas was the crop under trial. There were such divisions of the work as varieties, time and rate of planting, previous preparation of the land, cultivation or no cultivation after planting, and others. The object sought was to see which man could produce the largest, and at the same time most profitable crop. The entire neighborhood took an interest by the end of the season, and much of value was learned by all. Similar trials with rice, corn, mungo, and other crops might be carried on in the Islands to the advantage of all concerned. The especially strong feature of this plan is in being able to get information on so many of the factors affecting the crop under consideration, without putting too much of a burden on any particular individual. (*H. T. Nielsen.*)

AN INVITATION TO OUR READERS.

The distribution, or, strictly speaking, the localization, of some of the most common Philippine fruits and vegetables is a very interesting subject; for instance, even some of the most common fruit species like the mango, chico, mabolo, tamarind, etc., are limited to certain more or less circumscribed areas.

Certain fruits, such as the Durian, Mangosteen, Baño, and Marang, are of extremely limited distribution, some evidently never having been taken outside of their native habitat, while a study of their natural environment assures us that they can be grown in many other parts of the Islands where they are now unknown.

The Bureau of Agriculture, in an endeavor to remedy this defect, is now trying to assemble a collection of all Philippine fruits and vegetables, in order to study their habits, requirements, and uses, with the view first of improving them and second, of distributing them to the municipalities where they are not cultivated.

In order to assist the Bureau in this work the Philippine readers of THE PHILIPPINE AGRICULTURAL REVIEW are cordially invited to communicate with the Bureau relative to any useful plants growing in their respective municipalities; the absence of any fruit or vegetable that would be desirable to introduce there should likewise be noted. The Bureau will endeavor to supply seeds or plants of such species to any municipality where they are not now found.

Readers in foreign countries are also invited to communicate with the Bureau with the object of exchanging seeds and plants. All communications should be addressed to the Director of Agriculture, Manila, P. I. (*P. J. Wester.*)

THE NE PLUS ULTRA OF COCONUT RECIPES.

Partly on account of the deplorable scarcity of green coconuts in the Manila markets, the Manila housewife is seldom able to use any but the "dry" coconuts in her menage. In other countries, however, the value of the various forms of coconut foods is better appreciated than in the Philippines; in the West Indies, in particular, this delicious fruit, or nut as some prefer to call it, is very much in evidence.

A recipe which appears to be the best we have ever had the pleasure of seeing has been given by Mrs. Hamilton King, of Bangkok, Siam, and is obviously deserving a trial by every Philippine housewife. We take the liberty of quoting verbatim:

Coconut custards served in "shells."—Six small coconuts. Trim off the

outside green part. Cut off a small slice at the bottom, so the coconut will stand; and cut a piece across the top—leaving enough of the fiber to act as a “hinge” for the cover. Over the grated meat of one large, rich, ripe coconut pour the liquor, or “milk,” of three green coconuts, press hard, and strain. Add eight eggs well beaten and six teaspoons of thick condensed milk (as you take it from the tin). Sweeten to taste with palm (or *brown* in the Philippine Islands) sugar that has been rubbed smooth with a little of the coconut “milk.” Pour this mixture into the coconut “shells” and steam over *slowly* boiling water about one hour, being careful not to cook them long enough to make the custard “curdle.” Serve these with thin wafers or “kisses” or any kind of cake preferred.

(O. W. Barrett.)

THE PRESENT LOCUST SITUATION.

In view of the amount of damage done to the agricultural interests of these Islands in former years, the Second Philippine Legislature amended Act No. 817 of the Philippine Commission by passing in February, 1912, Act No. 2121, which changed the method of appointment of the Locust Board for each province, defined the relation of the Bureau of Agriculture to the locust boards, and appropriated the sum of ₱50,000 for locust destruction. This fund is to be expended under the rules and regulations prescribed by the Director of Agriculture.

Up to the present date reports of infestation have been received from twenty-three provinces. The extraordinarily dry season has been very favorable for locust development and the pest has appeared in more than usual numbers. The damage done by the locusts is not confined to the nymph or hopper stage—in fact greater damage is sometimes done by the large swarms of flying adults. These latter can easily travel 15 kilometers a day and, unless hurried or worried by the weather, destroy almost everything in the line of crops in their path.

As was expected, the outbreaks have been more numerous and severer in the southern islands than in Luzon. Samar, Leyte, Cebu, Bohol, and Mindanao are the scenes of the worst attacks. On the Islands of Cebu and Bohol it is estimated that about 40 per cent of the corn crop has been destroyed, while immense damages to coconuts and bamboo have also been in evidence. In many districts bamboos have been completely defoliated and the weight of the insects has even broken them. The coconut palms, especially along the east coast of Cebu and the west coast of Bohol, are defoliated and the crowns frequently broken; it will take at least two years before these injured palms will be in full bearing again.

In combating the pest, the destruction of eggs and hoppers is

the most effective measure. The flying locusts are very difficult to combat, but by the use of nets in localities where they are feeding, considerable numbers may be caught and destroyed. By plowing areas where eggs have been laid, a large part of them are either crushed or buried so deeply that the young hoppers can not emerge. As the Filipino plows do not turn a good furrow, but simply loosen the ground, it has been found necessary to use a roller, or to tightly pack the ground by use of hand mauls.

The pit system for the "hoppers" is most effective; by the use of corrals of sheet iron or other materials they can be driven into these pits where they are easily destroyed. Up to August 15, 7,700 cavans¹ of locusts had been destroyed in Bohol and at least 10,000 cavans in Cebu. The outbreaks in Luzon are confined to the district where the Provinces of Tarlac, Pangasinan and Nueva Ecija meet. Swarms have been reported from Vigan, in Ilocos Sur; Santo Niño, in Isabel; Iguig, in Cagayan; Floridablanca, in Pampanga; Bato, in Albay; Milagros, in Sorsogon; San Jose, in Ambos Camarines; and Batangas, in Batangas.

The southern islands, Cebu and Bohol, are almost completely infested. Leyte has had two severe outbreaks, Samar, six; Occidental Negros, one (official, and several presumed); Oriental Negros, six; and Mindanao, ten.

Act No. 2190 was enacted September 17, 1912, by the Philippine Commission, to amend Act No. 2121 of the Philippine Legislature, making the latter applicable to the "territory inhabited by the Moros or other non-Christian tribes." This Act appropriates ₱5,000 for carrying on locust destruction work in that territory. (*C. R. Jones.*)

BANANA PRODUCTION IN COSTA RICA.

In several parts of Central America and the West Indies the production of bananas for exportation to the United States assumes considerable importance. In Costa Rica, for instance, 40,000 hectares are planted to bananas and the monthly crop from this area ranges between 700,000 and 1,200,000 bunches, the cost of cultivation, harvesting, and preparing the crop for the market being about ₱400 per hectare. (*P. J. Wester.*)

SEEDS IN THE MOUNTAIN PROVINCE.

It is worthy of note that among the various out-of-the-way places to which collections of garden seeds have been sent by the Bureau during the past season, one of the most interesting from

¹ 1 cavan equals 75 liters.

the vegetable grower's point of view is Cervantes in the Mountain Province.

Although the dry season was, of course, very severe even in that district, such difficult varieties as New Zealand spinach, Lima beans, and turnips came through remarkably well. Tomatoes, eggplants, and radishes, of course, gave excellent returns. The Igorots are becoming greatly interested in maize, legumes, and grain sorghums; an effort will be made during the coming season to assist them to increase the number of varieties in their gardens and paddies, and especially to introduce citrus fruits, pineapple varieties, mangos and other fruits adapted to that district. (O. W. Barrett.)

ERRATUM.

Through an error, the name of the orchid, illustrated in Plate IV, Volume V, No. 9, of THE PHILIPPINE AGRICULTURAL REVIEW, English edition, was omitted. The name of this plant is *Grammatophyllum multiflorum* Lindl.

BOOK REVIEWS.

"COCO-NUTS, THE CONSOLS OF THE EAST."

By O. W. BARRETT, *Chief, Division of Horticulture.*

This Bureau has just received an important work bearing this title, by H. Hamel Smith and F. A. G. Pape.

The volume contains over 500 pages of very interesting matter on all branches of the coconut subject from selection of the seed to handling the finished products. The illustrations are numerous and well selected. It is published by the "Tropical Life" Publishing Department, of 83-91 Great Titchfield Street, Oxford Street, W., London, and sells for 10 shillings net (11 shillings postpaid). An important feature of the work is a foreword by Sir W. A. Lever, Bt., one of the world's leading authorities on oil products; there is also an interesting introduction on "Health in the Tropics," the substance of which every estate manager should thoroughly familiarize himself with.

A whole chapter is devoted to coconut planting in the Philippines; our Bulletin No. 17 is freely drawn upon and Messrs. Copeland, Worcester, and Lyon are also quoted to a considerable extent; the five interesting illustrations on copra making in the Philippines are among the best in the book. At the close of the work is a chapter on copra drying machinery and here Mr. Smith puts forward his ideas on both his Rotary Oven Dryer and his more recent plan for a large drying house using strong ventilating fans to force the air up through the several stories or floors of latticework. Moreover, there is an up-to-date chapter on the extraction of oils; and the various methods from the primitive "chekku," or camel mill, to the "Scott" Patent Solvent Extraction Apparatus are described. The extraction of fiber, of course, has its due space and even estate irrigation is discussed. Machinery for clearing new ground, for spraying palms of all sizes, and for modern-style estate cultivation, is fully described. A chapter on mulch by the writer is quoted intact from "Tropical Life" for February, 1910.

"SOIL FERTILITY LABORATORY MANUAL."

(Ginn and Company.)

By H. O. JACOBSON, *Agricultural Inspector.*

This textbook has been compiled by Cyril G. Hopkins, professor of agronomy, and James H. Pettit, assistant professor of soil fertility, both of the University of Illinois.

The volume is an outline of the practices evolved in ten years of experience in conducting classes in the study of soil fertility.

Most of these practices have originated at the University of Illinois; the other specific chemical directions are commonly based on those adopted by the Association of Official Agricultural Chemists.

The practices outlined cover the ground completely in ordinary analytical work with soils, feeds and fertilizers. The methods employed are those which embrace economy, speed, and accurate results. A large number of blank pages are interspersed in the book, making it possible to place permanent notes where they will be most convenient and useful.

The volume is concise, up-to-date and practical and can be recommended to students and teachers as one eminently suitable for their needs.

The listed price of the book is \$1.20.

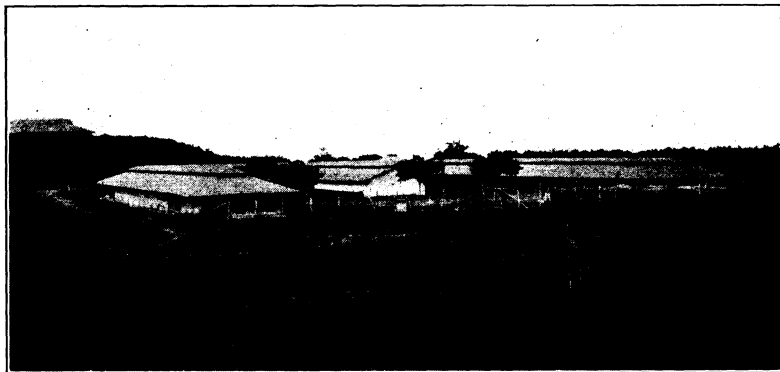
TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

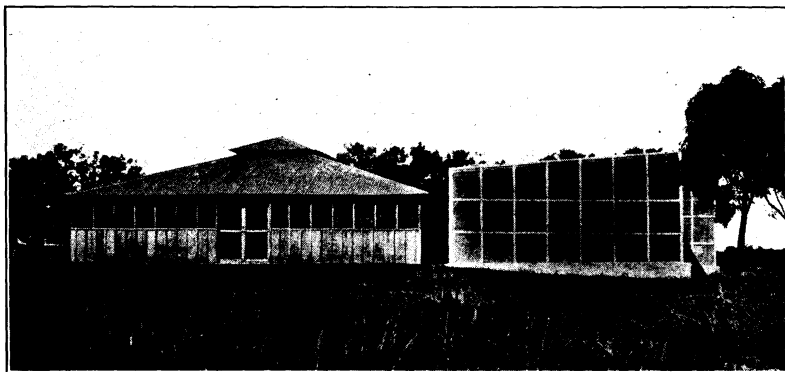
AUGUST, 1912.

[Temperature and rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.		Tem- pera- ture.	Rain- fall.	Tem- pera- ture.	Rain- fall.	Aparri.		San Fernando.	
	Tem- pera- ture.	Rain- fall.	Tem- pera- ture.	Rain- fall.					Tem- pera- ture.	Rain- fall.	Tem- pera- ture.	Rain- fall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	26.9		27.7		27.3	1.3	23.6	65.8	24.2	60.1	24.4	116.5
2	27.3		27.3		26.8	34.3	24.8	30.2	25.6	4.4	25.3	81.3
3	26.8	15	26.8		26.9	13.7	26.4	9.4	26.8	1.5	25.1	8.1
4	25.6		27		25.9	.8	26.2		27.2	1.8	27	2
5	27.1		26.9	4.8	26.3	10.9	27.4		27.8		27	50.3
6	26.6	7.1	27.4	1	26.6		25.8	18.1	27.8		27.2	26.7
7	26.5	1	26.7	26.7	26.2		27	24.4	28		26.6	.3
8	25.3	17.6	26.1	7.9	26.5	1.6	27.8		27.6	27.2	27.2	17.8
9	25.1		26.2	16.2	26.3		28.2	22.1	27.4	3.3	26.8	9.7
10	25.8	48.8	25.4	8.6	27.4		27.8	4.8	26.1	15.5	26	67.1
11	26.5	5.1	27.3	1.5	26.9	6.1	27.2	9.9	25.1	55.7	26.3	47.7
12	26.5	12.7	27.6		26.2	36.1	26.8	3.3	25.2	8.9	27	7.4
13	26.3	14.3	27.8		25.5	131.1	27.9	8.2	27	3.3	27	12.2
14	27.1	15.7	27.6	2	25.4	38.1	26.8	4.4	27.4	6.4	27.4	
15	27.3	1.3	27.5	3	27	2.8	27.8	15.3	27.2	1.8	28.2	20.8
16	27.9		26.9	1.3	26.7	10.1	27.8	30.5	27.4		27.4	2.3
17	27.4	2.5	28.1	1.5	26.6	3	28.2	12.7	27.6		26.2	59.7
18	26.6	1	27		27.4		27.6	.5	27	5.3	25.8	7.6
19	26.2	13.7	27.1	39.4	26.8		29.1	8.4	26.7		27.2	33.8
20	25.9	42.6	26.6	19.5	27.5		29.2	1.5	27.8		28	66.8
21	26.6	.3	27.1		26.7		28	2.8	28		27.3	8.9
22	26.1	27.5	26	48.2	26.4	11.6	27.6		28		27.8	36.1
23	26.3	.5	27.4	1.3	26.3	3.8	27.6	13	28	3.8	27.2	3.8
24	25.6	36.3	27.3		26.6		27.5	7.6	27.8	1.5	27.4	37.1
25	26.4	5.8	28		27.4	3	27.1	9.7	26.1	3.1	27	19.1
26	26.2	23.3	29		27.1	82.3	26.5	7.4	27.2		27.1	5.1
27	26.9	4.6	29		26.5	27.7	26.1	16.5	27.6		27.8	13.7
28	27.3	1.8	29.8		26.2	38.1	27	14.4	27.6		27.3	19.8
29	28.2		29.5		27.2	2.3	26.4	16.2	28		26.2	64
30	27.8		29		28		25.1	50.7	26	.8	24.2	128.6
31	27.1	17.2	29.1		28.1	77	24	40.4	26.6		24.2	72.6



(a) Group of sheds for general experimental work—operating room and screened stalls in wing on left.



(b) Screened shed and cage used for experiments in veterinary entomology.



(c) Main laboratory building.

PLATE I.—VETERINARY RESEARCH LABORATORY AT ALABANG, RIZAL.

VETERINARY NUMBER

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EDITORIAL.

THE ANIMAL-DISEASE QUESTION.

By the DIRECTOR OF AGRICULTURE.

This editorial is intended to be a plain statement, in language that any one may understand, of the present status of the animal-disease question, with special reference to rinderpest, and of the methods employed in fighting disease, and why they are used.

No one seems able to say just when or how rinderpest was introduced into the Archipelago, but at the time of American occupation it was here and has been present ever since.

In 1902 occurred a scourge in the way of a devastating epizootic of the disease which, according to the census of that year, wiped out forty-three per cent of the cattle and carabaos of the Islands, leaving 829,567 remaining. Since that time the Bureau of Agriculture has been waging warfare against rinderpest, various methods having been used, and various results attained. The use of serum has been followed, and then, as a general measure, dropped. The reason for this is that the serum only confers a temporary immunity from the disease, not averaging over three or four weeks. The expense is considerable and the results not commensurate.

Simultaneous inoculation has been used to a slight degree as a field measure, but that is an expensive operation, and accompanied by many fatalities. In fact every known plan has been tried, with the result that practically the entire dependence in the fight is now upon quarantine. No one can doubt that segregation and quarantine would, if universally and rigidly applied, entirely eliminate the disease in a very short time.

The number of cattle and carabaos in the Islands is increasing at the rate of 15 per cent per annum according to the semiannual enumerations made under an executive order, and there were reported 1,090,675 cattle and carabaos in the Islands on July 1, 1911. Add 15 per cent for the past year and we read 1,254,276. Animal lists made by representatives of this Bureau in connection with the rinderpest campaign warrant the conclusion that there are at least twenty per cent more animals in existence than are reported by municipal presidents. This would indicate the existence in the Islands at this time of a little over one and a half million cattle and carabaos.

The present rules and regulations are made and enforced to protect the animals now on hand, with the knowledge that in a very few years the supply will be entirely sufficient to meet every need for work and for food, provided, always, that the disease in the country is kept in check or reduced, and no new infection brought in.

The number of municipalities infected with rinderpest was, during the fiscal year ending June 30, last, cut down, by means of the methods now employed, from sixty-four to thirty-four and has been further reduced to eighteen at the present writing. That it is slowly but surely approaching the vanishing point, we sincerely trust. The number of animals dying from the

disease is now negligible, being not to exceed five head per day reported for the entire Archipelago.

The Bureau of Agriculture proposes to fight along the lines that have been so successful during the past year, and thus expects to deserve the approbation of the several hundred thousand owners of cattle in the Islands.

The numerous attacks of those financially interested in bringing in cattle, regardless of whether or not they are free from disease, have been and will be fought to a finish again, if necessary, in order that the hundred million pesos investment in this class of live stock may be protected.

The Director and various members of his staff have been sued, injunctions have been sought, and every possible attempt has been made to break down the quarantine now in effect. These attempts have all been futile, and, should future attempts be made, they will be fought as part of the day's work of the Bureau. The officials of the Bureau of Agriculture appreciate the great responsibility resting upon them in this matter and do not propose to swerve a hair's-breadth from the safe and sane methods necessary to stamp out the disease, no matter how loud the complaints of those who are willing and anxious to bring in stock from dangerous territory.

In the last year and a half that cattle and carabaos were admitted from the ports now quarantined, 85 per cent of the shipments were infected with either rinderpest or foot-and-mouth disease, or both, when they arrived in the Philippines.

The Bureau of Agriculture proposes to continue to stand like a stonewall against the importation of disease when it could by any possibility reach the animals of this country. The law places that responsibility on this Bureau and it does not propose to shirk it. On the other hand, the people may rest assured that their interests will be protected in every possible way.

THE CAMPAIGN AGAINST RINDERPEST.

By ARCHIBALD R. WARD, *Chief Veterinarian.*

Rinderpest is a purely contagious disease, that is, it is propagated primarily by transmission from animal to animal. While the objects contaminated by the discharge of sick animals seem to retain their infectivity for relatively short periods, there is no evidence that rinderpest infection lingers for months in any place except as transmitted by living animals. The disease apparently is totally unlike those in which the germ causing the disease lives in the soil and from thence is transferred to the animal. Anthrax, blackleg, and tetanus (lockjaw) may be mentioned as examples of such diseases which are totally unlike rinderpest in manner of spread. Furthermore rinderpest does not display evidence of being transmitted by insect carriers, as are such diseases as surra, yellow fever, Texas fever, malaria, etc. The determination of the peculiarities of the disease with reference to the foregoing points is a matter of the highest importance in determining the methods to be employed in combating it.

The spread of rinderpest is inseparably associated with cattle movement and contact between the healthy and the sick by means of which the virus of the disease is spread from one animal to another. The disease persists to-day where herds of cattle roam and intermix freely or where the customs of the people favor the mixing of animals. It has long ago disappeared from western Europe and Great Britain where range conditions no longer exist and where an enlightened public policy prevents its possible reintroduction in animals from countries where the disease exists. In this connection it may be observed that the disease has never yet invaded the Western Hemisphere nor Australia.

In rinderpest we have the most destructive, and, during certain periods, the cattle plague most commonly known to mankind. At one time or another it has swept Europe, Africa, Asia, and

outlying islands. Invasion by the disease has constituted national calamities, the problems connected with which have taxed the professional and administrative ability of the wisest.

The intimate association of the spread of rinderpest with cattle movement indicates the measures to be employed against it, such as the restriction of the movement of bovine animals by quarantine and particularly the discovery and isolation of the sick and exposed at the earliest possible moment.

In the present campaign particular effort has been made to ascertain the peculiarities of rinderpest in the Philippines by study of the disease in the veterinary research laboratory at Alabang. Experiments have shown that the period during which an animal is capable of spreading disease to others is short and that this period of infectivity takes place for the most part before the owner would recognize the animal as diseased except by the most thorough scrutiny. Observations made in the Philippines and elsewhere particularly emphasize the fact that there may occur mild cases of the disease in which the slight symptoms present could escape recognition as those of rinderpest. The disease may require as long as ten days before developing in an animal after exposure, so after the first discovery of infection other cases may be expected, during that time, among animals that have been in immediate contact with the sick ones irrespective of whatever measures of separation that have been enforced in the meantime. These considerations forbid permitting freedom of movement to apparently healthy animals, requests for which are repeatedly made by stock owners.

The measures of vital importance in combating rinderpest consist of separation of animals in an infected locality and the detection of the sick ones among them. Isolation checks the disease by preventing further contact and consequent possible infection of the healthy. Nevertheless the success of isolation measures is menaced by the possibility of indirect contact between the sick and the healthy through the medium of contamination of water supply, of men and of small animals coming in contact with each in spite of their direct isolation.

There are many obstacles in the way of accomplishing perfect isolation of animals largely due to the violation of quarantine measures by owners. Animals in the Philippines are customarily pastured together and the interdiction of the use of the common pasture necessitates the owners cutting grass or otherwise feeding the animal in lieu of the customary pasturing. The habit of the carabao of wallowing in mud puddles or streams is imperatively necessary and in its place the owner must neces-

sarily carry water to wet the animal, but by far the greatest obstacle consists in the necessity for the use of carabao and cattle in tilling the soil and moving crops to market. Animals used for traction follow the roads and this animal movement is comparatively easily controlled in a quarantined area. In addition, however, there is in the Philippines an extensive movement of animals bearing packs, or those for sale, or those being transported from one district to another to plow. These may move without reference to roads or even the numerous trails, inasmuch as there are few fences to restrain them.

Of equal importance is the discovery and isolation of animals infected with rinderpest. Suspected cases are kept under observation until the diagnosis is confirmed, after which the animals are placed in a corral where they are held until fifteen days after apparent recovery. It is impracticable to slaughter the sick on account of the cost of reimbursing the owners and it is further believed that no harm results in keeping the sick in isolation under the conditions provided. There is a slight advantage in that in some districts as many as 40 per cent of the animals recover. Inasmuch as they are immune to further attack they constitute a permanent asset to the country. The slaughter of the sick would increase the opposition of owners and make the discovery of cases even more difficult. Under most conditions animal movement is so free that the determination of animals that have been in actual contact with the sick is impossible and consequently their slaughter is quite impracticable. Furthermore these contact animals, even if known to have been associated with the sick, may be immune, in which case their slaughter would be worse than useless. Under conditions in which the number of sick and exposed susceptible animals could be accurately known, undoubtedly the best measures would consist in the slaughter of all of them. Such conditions as these exist most frequently in Europe and the United States.

A measure of great importance in a campaign is the collection of accurate data regarding the animal population and its location, without which, effort to control the movement of animals would be futile. One of the first tasks in a campaign is to compile these data with reference to name of barrio, municipality and province; owner's name; caretaker's name; carabao or cattle with sex, municipal brand, owner's brand, registration number, date of issue of ownership certificate and the date of compilation of the census. Where the disease does not actually exist, the time of inspectors, when not employed in investigating reports of disease, is spent in compiling this information to be

in readiness when needed. The opposition of owners to quarantine measures results in their failing to report cases, therefore the task of the Bureau of Agriculture does not merely consist in fighting rinderpest but in discovering it. Thus a constant system of inspection is necessary in which is employed the animal census to which reference has already been made.

The Bureau of Agriculture carries on the campaign against rinderpest with a force which, on June 30, 1912, consisted of 44 veterinarians, 64 American live-stock inspectors, and 223 Filipino live-stock inspectors. On that date there were also on duty 30 officers and 1,390 enlisted men of the Philippine Scouts, as well as 6 officers and 147 enlisted men of the Philippine Constabulary. These military organizations coöperate with the Bureau forces as quarantine guards and perform other duties incident to the campaign. Owing to the reticence of owners to report disease the Bureau regards the progressive search of a given piece of territory for the disease as of equal importance with the combating of existing disease, inasmuch as the aim of the campaign is the extermination of all infection. In supposedly clean territory which is being searched for disease all bovine animals are tied up for a period of ten days during which time a complete census is made as well as daily inspections. During this period passes for animal movement are given only under the most exceptional circumstances. Following this period a systematic triweekly inspection is continued for a variable period but interferes but little with the use of the animals for tilling the soil. However, they are not allowed to pass from one municipality to another during this period.

Upon discovery of infection the barrio in question is placed in quarantine. Exit of animals therefrom is prohibited and they are kept in isolation, being fed by the owner rather than by grazing. Until the expiration of twelve days no permits for animal movement of any kind are issued, but after this, in cases or urgent necessity, plowing may be permitted if the animals are kept on the piece of land in question.

The enforcement of the quarantine is effected by quarantine guards, moving as patrols day and night. The continuous inspection of the animals in the district and the neighboring ones is effected by the inspectors of the Bureau of Agriculture or by members of the Scout organization.

The construction of a corral for the sick animals is one of the first requirements. This is provided at the expense of the municipality. There is chosen a site well isolated from public roads and animals, care being further exercised in respect to

restraint of drainage therefrom to prevent conveying infection to other animals.

The corral consists of an inner square, provided with abundant shade, and an outer enclosure, all of bamboo, and designed to exclude small animals. Between these two is a strip in which the dead are buried. Around the whole of the inner inclosure is a deep ditch to obviate the danger of transmission of infection by flood water. All refuse is deeply buried within the inclosure. The frequent use of disinfectant minimizes the danger of transmission of infection therefrom. The caretaker, an employee of the municipality, attends the animals, receiving the fodder from the owners who come to the outer fence, but are not allowed within. Access to the enclosure is limited to those having business therein and the strictest precautions are taken to prevent the carrying out of infection on shoes or on any article such as ropes or baskets. Sick animals are kept in this corral for fifteen days after apparent recovery.

The quarantine in the barrio is maintained for thirty days after discovery of the last case of rinderpest. In connection with this work the following forms are employed:

NOTICE OF QUARANTINE.

To Address

Location of quarantine

You are hereby notified that the head of are placed in quarantine in accordance with provisions of paragraph (A), section 6, Act 1760 of the Philippine Commission.

That these animals are not to be removed from the above address without written permission of the Director of Agriculture.

(Signed) F. W. TAYLOR,

Director of Agriculture,

By
Inspector.

Received
(Owner or agent.)

....., 191 .

[In triplicate.]

"TIE UP" ORDER.

....., 191
(Date)

The President of

You are hereby notified that a contagious infectious disease of known as exists in the barrios of

..... in your municipality and you are requested to have all of the in these barrios tied up separately at the houses of their respective owners until released by a Veterinarian of the Bureau of Agriculture.

Very respectfully,

.....
Supervising Veterinarian.

(To be issued in triplicate; one copy to be retained; one to be handed to the president, and one forwarded to this office.)

INSPECTION ORDER.

....., 191
(Date)

The President of

You are hereby requested to have all of the carabaos and cattle in the barrios of tied at the houses of their respective owners on the following dates: for inspection.

Very respectfully,

.....
Supervising Veterinarian.

(To be issued in triplicate; one copy to be retained; one to be handed to the president; one forwarded to this office.)

PASS FOR WORKING ANIMALS.

Municipality of Date 191

Permission is hereby given to Mr. in the barrio of to work This animal is to be kept at when not working and is subject to inspection at all times.

Brands.

Sex.

Age.

.....
This pass may be recalled at any time and must be carried by the man working the animal.

.....
Supervising Veterinarian.

(To be issued in duplicate, one copy for owner; duplicate furnished Scout officer in charge.)

(Certificate of ownership will be presented by owners and held by the veterinarian in charge until pass is taken up.)

WEEKLY MUNICIPAL RINDERPEST REPORT.

....., P. I.,, 191

Barrio.	Cases from last week.		New cases.		Deaths.		Released.		Remaining at end of week.	
	Cara-baos.	Cattle.	Cara-baos.	Cattle.	Cara-baos.	Cattle.	Cara-baos.	Cattle.	Cara-baos.	Cattle.
Total for town.....										

Number of cases in court during week: Pending Disposed of

Names of barrios placed in quarantine:

Names of barrios released from quarantine:

Names of employees on duty in town:

REMARKS:

For week ending Saturday,, 191

(Sgd.)

Adequate means for combating the disease were first made available by the generous public-spirited action of Major-General J. Franklin Bell, commanding Philippines Division, who, on the request of the Governor-General of the Philippine Islands, promptly assigned Philippine Scouts to the rinderpest campaign. His determination to win, but without unnecessary friction with the people, likewise permeates the rank and file of the organization. The enthusiasm, patience and tact of the officers have been an important factor in producing the results obtained.

The Commanding General, Philippines Division, assigned the general supervision of Scouts on rinderpest quarantine duty to Capt. Peter W. Davison, aid-de-camp. He worked directly with the Bureau of Agriculture in all details involving Scouts so as to carry on the campaign in accordance with the plans of the Bureau.

Maj. W. R. Sample, U. S. Army, was assigned directly in charge of the first troops engaged on this work and perfected an organization to harmonize with that of the Bureau. He was succeeded in this assignment by Maj. Fred R. Brown, P. S. (captain of infantry).

Maj. H. A. Ripley, P. S. (captain of infantry), remained at Camp Stotsenburg in charge of instructions, drill and target

practice of Scout troops when temporarily withdrawn from rinderpest work.

Organizations and officers participating in the quarantine work consist of the following:

ROSTER OF TROOPS AND STATIONS IN LUZON.

Maj. W. R. Sample (relieved).

Headquarters Ninth Battalion.—Maj. F. R. Brown (captain of infantry); Lieut. J. F. Usry.

Headquarters Eighth Battalion.—Maj. H. A. Ripley (captain of infantry); Lieut. Oscar A. Manseau.

Seventeenth Company, Philippine Scouts.—San Fernando, La Union, and north: Capt. C. L. Stone, Lieut. Fred Damman, Lieut. P. D. Dulay.

Third Company, Philippine Scouts.—Binangonan and Tanay, Rizal: Capt. F. M. Conklin, Lieut. William Buerkle, Lieut. S. E. Shearer.

Nineteenth Company, Philippine Scouts.—San Fernando, La Union, and south: Capt. Harry F. Wilson, Lieut. B. E. Nickerson, Lieut. F. T. McCabe.

Twentieth Company, Philippine Scouts.—Camp Stotsenburg, Pampanga: Capt. Clay Platt, Lieut. H. J. Castles, Lieut. J. F. Daye.

Twenty-third Company, Philippine Scouts.—Santo Tomas, La Union, and Pangasinan—Union line: Capt. I. F. Costello, Lieut. Clarence S. Gould, Lieut. Max Sebald.

Twenty-fifth Company, Philippine Scouts.—Dagupan, Pangasinan: Lieut. George M. Clevenger, Lieut. John McNeil.

Twenty-sixth Company, Philippine Scouts.—Biñang, Laguna: Capt. H. M. Joss, Lieut. C. N. Cecil, Lieut. Per Ramee.

Twenty-seventh Company, Philippine Scouts.—Camp Gregg, Pangasinan: Capt. Peter Peterson, Lieut. C. F. Codori.

Twenty-eighth Company, Philippine Scouts.—Calamba, Laguna: Capt. A. W. Barry, Lieut. F. H. Mann.

Thirty-second Company, Philippine Scouts.—Camp Stotsenburg, Pampanga (detachments Guagua and Floridablanca): Capt. George M. Wray, Lieut. Hugh Straughn, Lieut. L. S. Williams.

Thirty-fifth Company, Philippine Scouts.—San Pablo, Laguna: Capt. M. E. Morris, Lieut. Edward Parfit, Lieut. W. H. Sullivan.

Thirty-eight Company, Philippine Scouts.—Subic, Zambales: Capt. George F. Abbott, Lieut. Thomas Gordon, Lieut. T. A. Lynch.

Thirty-ninth Company, Philippine Scouts.—Camp Stotsenburg, Pampanga (detachment Arayat): Capt. Emil Speth, Lieut. Joseph W. del Alamo, Lieut. J. M. Harris.

Forty-eighth Company, Philippine Scouts.—San Antonio, Zambales: Capt. Edward Bennett, Lieut. F. L. Hoerner.

Forty-first Company, Philippine Scouts.—Camp Gregg, Pangasinan: Capt. Howard White, Lieut. Harry A. Seymour.

(NOTE.—The above companies comprise, on the average, one hundred enlisted men.)

The following lieutenants in the Medical Reserve Corps, in order of assignment, have performed duties in connection with troops on rinderpest quarantine duty: F. M. Wall, V. E. Watkins,

F. M. Wells, H. F. Philips, L. A. Lavanture, G. W. Cook,¹ A. M. Guittard, H. W. Yemans, W. A. Christensen, L. B. Peck, A. McD. Coffey, F. H. Mills, J. C. Griffin, V. E. Miltenberger.

Rinderpest work was started in the Province of Panay under charge of Maj. Hanson E. Ely, Philippine Scouts, who was succeeded by Maj. Alvord Van P. Anderson, Philippine Scouts, who is now in charge.

Troops operating in Panay.

Organization.	Commissioned personnel.	Enlisted strength.	Remarks.
Headquarters Fifth Battalion Philippine Scouts.	Maj. H. E. Ely, Lieut. R. G. Craven, Lieut. J. W. Strohm.	-----	Relieved by Major Anderson, July 10.
Headquarters Seventh Battalion Philippine Scouts.	Maj. A. V. P. Anderson, Lieut. E. C. Wright, Lieut. J. M. White.	-----	Assumed charge, July 10.
Seventh Company Philippine Scouts.	Capt. R. E. Brooks, Lieut. H. M. Rimmer, Lieut. J. P. Vachon.	105	Lieutenant Rimmer also attached to Tenth Company.
Tenth Company Philippine Scouts.	Lieut. H. M. Rimmer	51	Relieved.
Thirteenth Company Philippine Scouts.	Capt. H. McElderry, Lieut. E. B. Miller, Lieut. W. P. Kelleher.	109	To be sent back to Camp Connell, Samar, about November 15.
Twenty-first Company Philippine Scouts.	Capt. R. Dickson, Lieut. J. S. Young, Lieut. M. F. Cooney.	111	Work in Panay completed.
Twenty-fourth Company Philippine Scouts.	Capt. S. M. Neisser, Lieut. R. G. Craven, Lieut. A. Tucker.	102	
Forty-ninth Company Philippine Scouts.	Capt. C. M. Spears, Lieut. L. B. Bennett.	109	To be returned to Camp Ward Cheney about November 15.
Medical Corps -----	Lieut. G. P. Stallman, Medical Reserve Corps.	(a)	

^a Detachment of Hospital Corps.

The Sixth Company, Philippine Scouts, in charge of Lieut. Patrick Moylan and Lieut. John F. Miller, are operating in northern Leyte.

From time to time other officers and detachments from some other organizations have been temporarily on rinderpest duty, but the names and organization from which the detachments were drawn are not available at the moment.

The Philippine Scouts are an indispensable adjunct in the campaign, not only as quarantine guards, but by actual participation in work of inspection in the infected and suspected territory. The following specimens of instructions and forms, selected at random, illustrate the admirable military thoroughness with which the work is done:

NONINFECTED BARRIOS.

The following instructions will be enforced by all members of the Nineteenth Company, Philippine Scouts, on quarantine duty in the barrios NOT INFECTED WITH RINDERPEST, in the municipality of _____, P. I.:

¹ Medical Corps.

1. Allow no carabaos or cattle to leave the municipality, except when a guard is furnished by the company commander (authorized by the veterinarian in charge).

2. All carabaos and cattle must be tied up or placed in corrals on the premises of the owner or caretaker, on the days and dates specified for inspection, and thus held until the inspection is completed.

3. All places where cattle or carabaos are detained, must be kept in a sanitary condition at all times.

4. In the below-named barrios, on the dates specified, the noncommissioned officer in charge of each post will detail men to inspect and list all carabaos and cattle, using the blank form provided for that purpose. Should a sick or suspicious animal be found, it will be isolated immediately, placed under guard, and the matter reported without delay, using the blank form provided for that purpose.

Names of barrios.	Dates of inspection.
-----	-----
-----	-----
-----	-----

5. Upon completion of all required inspections (if no infection is found) the teniente of each barrio will be notified in writing that the animals have been inspected and are no longer required for inspection, that date.

6. The animals of more than one owner should never be assembled in one place for inspection, as the mixing of animals of various owners is the chief means of spreading infection.

7. When animals are absent from inspection for any reason, the matter must be investigated very closely, and the owners or caretakers required to produce the animals, if possible, as absent animals are the ones that are sick generally. Owners or caretakers must be informed that if animals are absent from inspection a second time, it will be necessary to place the delinquent animals in quarantine for ten days.

8. On days when animals are not required for inspection, they will be allowed to go free within the limits of the municipality (except in barrios quarantined). The necessary patrols must be made to see that there is no violation of this rule.

9. Any irregularities found to exist in regard to quarantine rules must be reported to the veterinarian, the live-stock inspector, or "special inspector" visiting each post daily.

(Signed) H. F. WILSON,
Captain, Philippine Scouts,
Commanding Nineteenth Company.

INFECTED BARRIOS.

The following instructions will be enforced by all members of the Nineteenth Company, Philippine Scouts, on quarantine duty in the municipality of _____, P. I.:

1. All animals (except horses and mules) must be tied up or kept in corrals, until written notice of release is furnished the teniente of each infected barrio, by the representative of the Bureau of Agriculture in charge of the municipality.

2. Two men will inspect daily all carabaos and cattle, and the non-commissioned officer in charge of each post will arrange his detail of men in such a manner so as to have the animals inspected by different men each day.

3. A careful check must be made of the number of animals inspected, and a record of same will be kept on the blank form provided for that purpose.

4. At any time when a sick or suspicious animal is found it must be isolated immediately, placed under guard, and the matter reported without delay, using the blank form provided for that purpose.

5. All places where carabaos or cattle are tied, or where they are kept in corrals, must be kept in a sanitary condition at all times. A separate sink for each animal must be dug about one meter wide and one meter deep, and all refuse matter from each animal deposited therein. When the animals are tied up, they must be kept at least twenty feet apart.

6. Upon completion of inspection of an infected animal, or, upon leaving an isolation corral containing infected animals, the disinfectant furnished by the Bureau of Agriculture will be used as directed by the veterinarian in charge. No person except a representative of the Bureau of Agriculture will be allowed to enter an isolation corral, which must be guarded at all times.

7. Patrolling will be so arranged by the non-commissioned officer in charge of each post, that there will be absolutely no movement either during the day or night of any carabaos or cattle.

8. All quarantine orders must be enforced with firmness, kindness and justice, and, if any irregularities are found to exist in regard to the quarantine, they must be reported without delay to the veterinarian in charge, or live-stock inspector, or "special inspector" visiting each post daily. If the matter be of a serious or important nature, the report should be forwarded by messenger without delay to headquarters.

9. All lawful instructions from representatives of the Bureau of Agriculture concerning the quarantine will be received, transmitted and obeyed by each member of this organization.

10. Each member of this organization will assist by every legitimate means the officials and representatives of the Bureau of Agriculture in carrying out the spirit of the work in connection with the quarantine, with a view to ultimate success.

(Signed) H. F. WILSON,
Captain, Philippine Scouts,
Commanding Nineteenth Company.

Date, _____, 191

The TENIENTE,

Barrio _____, *P. I.*

You are hereby notified that the inspection of carabaos and cattle in your barrio has been completed, and the animals are no longer required to be tied up, or kept in corrals during the balance of this day.

Very respectfully,

_____ Co., P. S.
Acting Live-stock Inspector, Bureau of Agriculture.

(Not to be submitted if infection is found.)

Report of animals inspected by detachment Co., Philippine Scouts, from Post No., located in the barrio of P. I.

Name of barrio.	Municipality.	Province.	Date.	Total present.	Total absent.
Carabaos					
Cattle					

Inspected by—

....., Co., P. S.

....., Co., P. S.

(Enter on back of form, name of owners or caretakers of animals absent.)

Report of animals found sick by detachment Co., Philippine Scouts, from Post No., located in the barrio of P. I.

Carabaos.	Cattle.	Male or Female.	Brand.	Owner.	Caretaker.	Barrio.	Date.

Found by—

Time { a. m.
..... p. m.

Corporal, Co. P. S. in charge of Post No.

(As soon as a sick or suspicious animal is found, it must be isolated immediately, placed under guard, and this report forwarded without delay to the veterinarian in charge of the municipality.)

Weekly report Date,, 191
District, municipality of P. I.

Barrios inspected.	Animals present.	Animals absent.	Remarks.

NOTE.—Enter under "Remarks" brief information of infected or suspicious animals found during the week, and all irregularities found to exist.

Sergeant, Co., P. S., Special Inspector.

Distribution of detachments and posts of Nineteenth Company, Philippine Scouts, and days of inspection of animals in barrios.

Municipalities.	Number of men.	Number of post.	Names of barrios.	Days of inspection.
Bacolor ^a			Cabalantian	Every Monday.
Do			San Vicente	Do.
Do	8	6	Maliwalo	Every Tuesday.
Guagua ^a			San Matias	Every Monday.
Do			San Roque	Do.
Do			San Juan Bautista	Do.
Santa Rita ^a			Diladila	Every Monday and Thursday.
Do			San Juan	Every Tuesday and Friday.
Do	10	2	San Jose	Every Wednesday and Saturday.

RÉSUMÉ.

No.	Municipalities.	Barrios.	Posts.	Officers.	Enlisted men.	In-spections.
1.....	Bacolor	15	3	1	33	15
2.....	Guagua	22	3		25	27
3.....	Santa Rita	10	5	1	48	30
Total	3	47	11	2	106	72

^a These municipalities contain many more barrios than shown in this model report, thus totals in résumé do not coincide with the data shown.

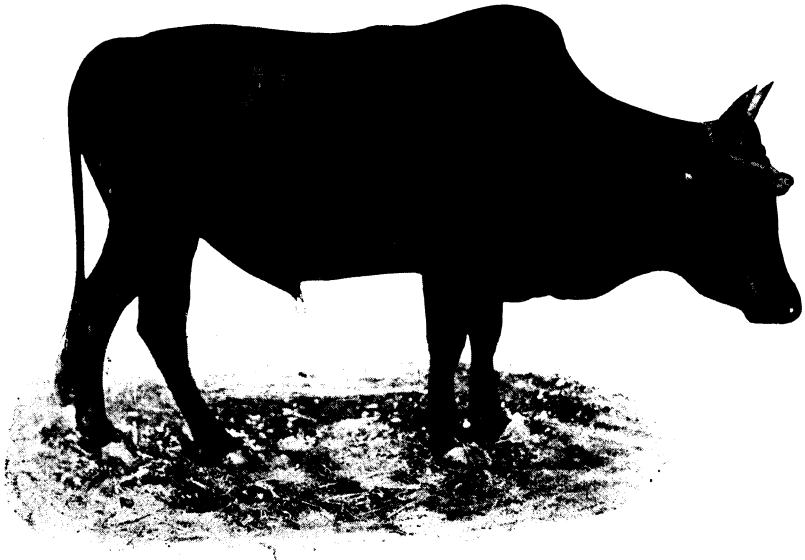
(Signed) H. F. WILSON,
Captain, Philippine Scouts,
Commanding Nineteenth Company.

NOTE.—The schedule of inspection is arranged by the veterinarian in charge and is subject to change by his direction.

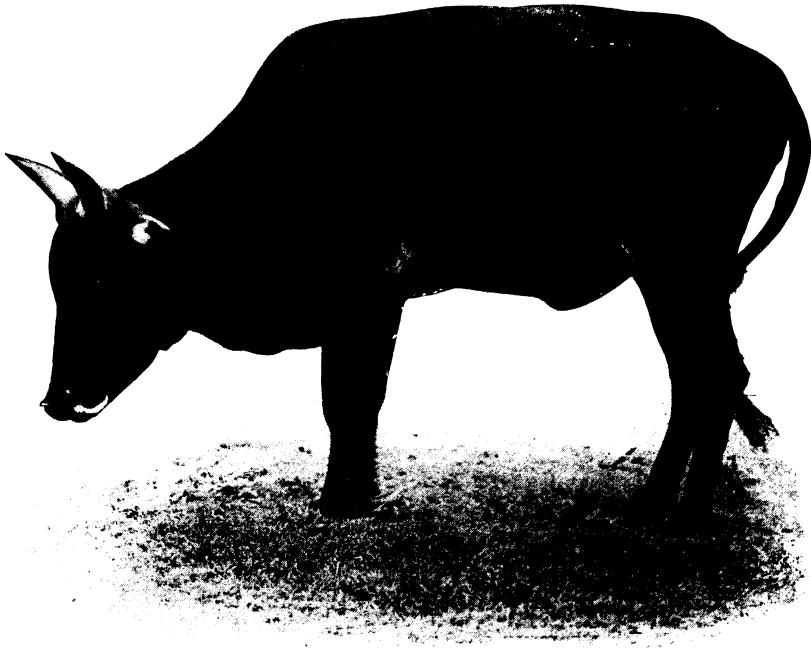
The rinderpest campaign with Philippine Scouts has involved work in Leyte, Cebu, Oriental Negros (and subprovince of Siquijor), Iloilo, Laguna, Bulacan, Nueva Ecija, and Bataan, all of which are believed now to be free from rinderpest. Work is in progress in Leyte, Capiz, Rizal, Zambales, Pampanga, and La Union.

The Philippine Constabulary is aiding in various minor outbreaks to the fullest extent possible consistent with the size of the force available for this and the other important duties of that organization.

The progress of the work is shown by the table illustrating rinderpest conditions:



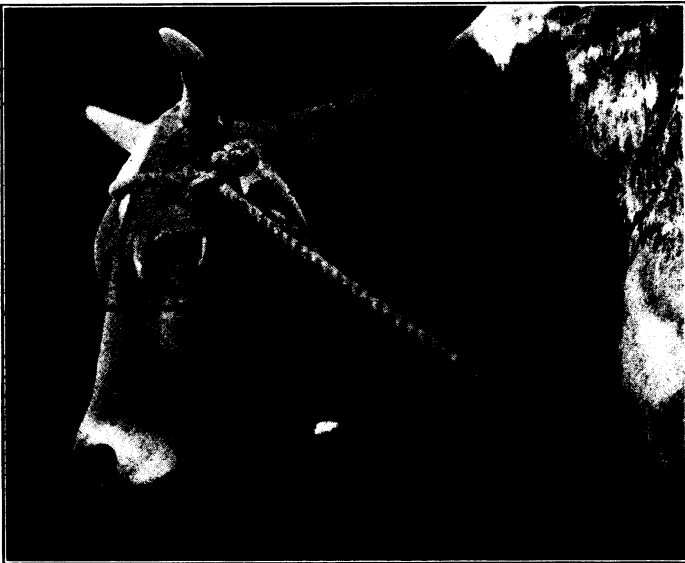
(a) Batanes bull, third day of temperature—shows drooping of head, lopping ears, congestion of veins of face, and general depressed appearance.



(b) Batanes bull in the latter stages of rinderpest—shows general depressed appearance, drooping head, lopping ears, arched back, eyes sensitive to light, staring coat, and emaciation.



(a) Indo-Chinese bull, fourth day of temperature—shows discharge from the eyes and their extreme sensitiveness to light.



(b) Batanes bull in latter stages of rinderpest—shows general depressed appearance, lopping ears, drooping head, discharge from eyes, and drooling from mouth.



(a) Indo-Chinese carabao in the latter stages of rinderpest—shows head held around to side, uneasy position, due to front leg being knuckled under neck.



(b) Formosan cow in the latter stages of rinderpest—shows head held near flank and depressed appearance.

TABLE I.—*Rinderpest.*

Fiscal years.	Quarters.	New cases.	Deaths.	Average number—	
				Barrios infected.	Municipalities infected.
1911-12	First	1,276	937	110.2	43.4
	Second	1,240	827	77.4	35.4
	Third	997	559	69.3	26.9
	Fourth	799	524	60.0	30.8
1912-13	First*	606	390	46.6	24.0

* Ending September 30, 1912.

During the week ending November 2, 1912, municipalities in which rinderpest was known to exist were as follows: Isabela, 1; La Union, 5; Pangasinan, 2; Tarlac, 1; Pampanga, 4; Rizal, 1; Zambales, 2; Capiz, 1; Antique, 1; a total of 18. Of these there were cases discovered in only 12 during the week.

While rinderpest is not doing serious damage at the moment its presence is a potential danger of grave magnitude. All efforts are being directed to extinguishing the last embers of infection, lest later a conflagration be kindled from them.

SYMPTOMS AND LESIONS PRESENTED BY CATTLE AND CARABAOS SUFFERING FROM RINDERPEST IN THE PHILIPPINE ISLANDS.

By WILLIAM HUTCHINS BOYNTON, D. V. M., *Pathologist.*

In rinderpest, as is true for most infectious diseases, occasionally animals do not present the symptoms and pathological changes which are supposed to be typical of that disease. In this particular paper the writer intends to describe only those symptoms and pathological changes which are most prevalent in cattle and carabaos suffering from that disease.

SYMPTOMS.

The first symptom of rinderpest is a rise of temperature above normal. This high temperature continues with little variation throughout the course of the disease. In fatal cases the temperature often falls below normal just before death. In those cases which recover, the temperature gradually subsides to normal.

The normal temperature of cattle and carabaos in the Philippine Islands varies somewhat with the season of year. During the hot dry season it is usually from three-tenths to seven-tenths of a degree higher than during the rainy season. The average normal temperature varies from 37.7° C. to 38.4° C. in the morning, and 38.5° C. to 39.5° C. in the afternoon. These temperatures were observed in animals which were at rest and in the shade. However there may be great variations in the temperature of animals which are standing in the sun or that have been deprived of water, or are at work. In such cases the temperature may be a degree or more higher than that when at rest and in the shade.

In rinderpest, during the maximum of the febrile period, the morning temperature of an animal at rest varies between 39° C. and 40° C. The afternoon temperature varies between 40° C. and 41° C. the average being about 40.6° C.

The first rise of temperature varies from the third to the fifth and in some cases the sixth day after the animal has come in contact with sick animals, their excreta, or after artificial inoculation with virulent material. Usually an animal which contracts the disease naturally shows a slightly longer incubation period than an animal which has been inoculated with virulent material.

On the first day of temperature, an animal affected with rinderpest usually has a more lively appearance than normal. The eyes are bright, it is easily excited, and shows many evidences of being under a slight nervous strain. This appearance is more prevalent among cattle than carabaos, and also among the smaller more excitable type of cattle than in the larger breeds.

On the second or third day of temperature the animal usually becomes docile. In many instances the hair does not lie as smoothly over the body and loses the glossy appearance which is present in a healthy animal. The ears lop forward and the conjunctivæ become congested. The eye lesion is especially prominent in carabaos, and in many instances is present on the first day of temperature.

As the disease progresses the animal usually becomes listless. The head droops to the ground, the eyes become sensitive to light, and as a result they are kept closed or partly so, most of the time. As a rule there is a profuse discharge of tears from the inner canthus of the eye. The tears run down the face and keep the hair and skin constantly wet. Frequently in the later stages of the disease there is a sero-purulent discharge from the eyes. However, the eye lesions are quite varied in cattle and in some instances are hard to detect, except the sensitiveness to light which is most constant. Frequently in those cases where there is a profuse discharge of tears, the inner canthus of the eye will be swollen, the area over which the tears run will have a scalded appearance and the hair usually falls out.

The nostrils become congested and in many cases there is a sero-purulent, or a thick viscid discharge from them. The muzzle is usually hot and dry.

The onset of diarrhea varies somewhat in different animals. The average is in the neighborhood of the third or fourth day after the rise in temperature. As a rule diarrhea makes its appearance a little earlier in carabaos than in cattle. Diarrhea is sometimes preceded by slight constipation, but this feature is not constant. Usually with the onset of diarrhea an animal loses appetite, which condition rapidly increases. In a day or

so it will refuse food, rumination ceases, and there is marked thirst. At this period of the disease the animal usually stands with the back arched, the hair does not lie smoothly over the body, the head is held near the ground, the ears lop forward, and the eyes are closed or partly so. If the animal is watched closely, frequent tremors may be seen to run through the body, as if the animal were suffering from a chill.

There is usually a slight, and, in some cases, a profuse drooling from the mouth, and, in many instances, the animal will be heard grinding the teeth. Although this is not a constant symptom, it is quite prevalent especially in the latter stages of the disease. The animal, as a rule, looses flesh rapidly from the onset of diarrhea to either death or recovery. In the latter stages the feces become very liquid and have an offensive odor. In some cases blood and mucous casts are present but these elements are not constantly present.

As a rule the animal strains a great deal while defecating and in some cases groans as if in great pain while in the act. In cases where the animal becomes very weak and is not able to arch the back, the anal sphincter muscle looses its tension and apparently becomes paralyzed. The animal holds its breath and by tucking up the abdomen is able to force the fecal matter out. This act is accompanied by grunting, groaning, and sucking in and expelling air from the anus. The watery fecal matter runs down the thighs and soils the hair on the legs and tail. Frequently in the latter stages of fatal cases the animal will be seen defecating involuntarily. These appearances usually occur just prior to death.

About the time diarrhea sets in, or a day or so after, erosion ulcers are frequently found in the mouth. The animal's breath is usually foul-smelling. The erosions are usually located on the inner surface of both upper and lower lips, at the commissure of the lips and on the conical papillae. The erosions may be diffuse giving the inner surface of the lips a scalded appearance or there may be isolated areas either circular, oblong or with jagged uneven borders. These are covered with a yellowish gray exudate which is easily removed, leaving a raw surface underneath. The conical papillae in many cases are partly or completely eroded off. Now and then, erosions on the dental pads have been noticed, and they are also frequently present on the hard palate. As a rule these erosions are not deep but merely extend through the epithelial layer; in some instances, especially where secondary infection has taken place, they are deep-seated.

In some cases, especially in carabao, about the time diarrhea starts, an exudate may be present in the pocket-like cavity located between the root of the tail and the anal opening. This exudate is usually of a dirty yellowish color, moist and cheese-like. It is quite easily removed, leaving a raw surface underneath having the appearance of being covered with pustules. This appearance is not constant, but when present may be considered as a positive lesion of rinderpest.

In the latter stages of the disease the animal as a rule lies down the greater part of the time. It usually rests on the left side, apparently to have as little pressure as possible brought upon the fourth stomach, duodenum, caecum, and colon. In many instances colicky symptoms are shown by the fact that the animal will persistently keep the head against the side, show all the symptoms of pain and groan frequently.

In some instances the animal will remain standing to within a few minutes of death, when it drops, struggles violently for a short time, often uttering low muffled bellows. When at the point of death, the head is thrown back, the body becomes rigid, and the eyes open with a wild stare. Frequently there is wrinkling of the face with opening and closing of the mouth. In other cases the animal may lie in a sprawled-out position for a period varying from several hours to a day before death and hardly move.

Usually in fatal cases, the animal becomes extremely weak in the hind quarters, and has a wobbly gait when it attempts to move. On the other hand some animals appear strong up to within a short time of death.

Some cases, especially among the small nervous breeds of cattle during the latter stages of the disease, show twitching of the limbs which may appear in either the front or hind quarters. The writer has noticed this symptom so marked in a bull that the animal was unable to keep the affected limb on the ground.

In the latter stages of the disease erosions, covered with a yellowish-gray exudate, may be found on the lips of the vulva, but this lesion is not constant. One of the apparently constant lesions in the male is congestion of the penis. In some instances erosions may be present, and there is usually a slight thick, yellowish, purulent discharge from the sheath. Often this discharge is cheese-like and similar to the exudate which covers erosions in other parts of the body.

The duration of the disease in fatal cases varies from three to ten days after the initial rise in temperature. The average

is in the neighborhood of six days. In some instances an animal may regain its normal temperature and begin to eat, but is not able to regain its strength. Such cases usually die in three or four weeks.

The body of a carabao after recovery from rinderpest frequently becomes covered with an eruption having the appearance of pustules. This lesion is especially prominent on the neck and belly. Possibly this eruption may be caused by the fever through which the animal has passed. This appearance, however, is not constant and the writer has never noticed it in cattle.

MORBID ANATOMY.

When performing an autopsy upon an animal which is supposed to have died of rinderpest, too great precaution can not be taken in examining every part of the carcass. Every lesion found adds to the strength of verifying the case in question.

As stated before, this paper only deals with the ordinary case of rinderpest. The marked variations which sometimes occur are not considered here.

For convenience of description we will start at the head and describe the conditions found through the body in the order of the location of the organs.

The first things to look for are: Marks of a discharge from the eyes, swelling of the inner canthus, has hair fallen out around this area or in the track where the tears have run down the face. One should also notice if the hind legs and tail are soiled from fecal matter. The nostrils should be examined for any discharge, or congested appearance of the mucous membrane, and the mouth should be examined for the erosions which have been mentioned.

Upon opening the head, the lining of the superior turbinal cavity is frequently found congested. The area of the inferior turbinal cavity is almost constantly congested, and at times to such an extent that it takes on a purplish red color. This cavity may also be partially occluded by the marked congestion present.

In many cases the septum nasi is markedly congested, and swollen to such an extent as to partially or practically occlude the cavity. This undoubtedly is one of the causes for the difficulty which some animals experience in breathing through the nose during the latter stages of the disease.

The brain and spinal cord have been found markedly congested

in every case in which the writer has looked for this particular condition.

Erosions covered with grayish-white exudate are constantly found on the palate, walls of the pharynx and at the base of the tongue. Congestion of the epiglottis and arytenoids is very constant. Congestion and in some cases hemorrhages in the upper portion of the trachea are quite constant. Congestion, and in the majority of cases, erosions covered with a yellowish-gray exudate are present in the upper portion of the esophagus.

The lungs, as a rule, show no very marked changes. Occasionally emphysema is prominent, but this appearance is not constant. Sometimes congestion is present, but one has to be careful and not mistake hypostatic congestion for a lesion of rinderpest.

In a certain percentage of cases hemorrhages are found either on the external surface or on the inner walls of the heart. The appearance of these lesions varies considerably in different outbreaks and different strains of virus. In some instances heart lesions will be present in a high percentage of cases, while in others they are seldom found. In practically every case the heart muscle is rather pale in color. When lesions are present, they appear as small hemorrhages usually located along the coronary or the longitudinal grooves. When hemorrhages are present on the inner walls of the heart they appear in the left ventricle. In but one instance has the writer noticed hemorrhages in the right ventricle and in this case there were also extensive hemorrhages in the left ventricle.

The gall bladder is, as a rule, considerably distended with bile. The bile may vary from a dark green to a light-yellow color. It may be watery or very thick in consistency. In those cases where the bile is thickened, the bile capillaries in the liver are markedly congested, and the liver as a rule is bile-stained. The gall bladder is usually congested. In some cases the congestion is slight while in others it is very marked. A few cases have been noticed where ulcers were present.

The liver is usually congested, shows the appearance of cloudy swelling and in some instances is bile-stained.

The kidneys as a rule are slightly congested and may show a blotchy appearance over the cortical surface.

The pancreas and spleen, in the writer's experience, have a normal appearance.

The lymphatic glands, as a rule, are affected. Those located in the mesentery show the most prominent changes. The glands

are enlarged, frequently congested, and, in some instances, oedematous.

The urinary bladder is quite constantly congested, sometimes shows hemorrhagic areas, and the walls may be thickened. There is usually a marked congestion of the upper portion of the urethra as it leaves the bladder.

In the first, second and third stomachs there are no noticeable lesions except in extraordinary cases where the epithelial layer of the first stomach is rather easily removed. In some instances ulcers have been found in the third stomach around the valve which separates it from the fourth stomach. This appearance has been noticed only in those cases where there was marked ulceration of the fourth stomach. By all appearances the ulceration extended through the valve from the fourth stomach into the third. The contents of the third stomach are usually very dry.

The fourth stomach as a rule is the organ in which some of the most marked pathological changes occur. Its appearance varies considerably in different cases. Usually the contents are liquid, of a very foul odor, and often contain a considerable amount of mucus. The mucous membrane may be found in various grades of inflammation, from a slight pinkish to a deep purple color. The areas of inflammation also vary. In some cases it is localized in the lower portion of the stomach, in others near the pyloric portion, and in others it is diffuse throughout. Erosion ulcers are quite constant and may be distributed in a similar manner as described for the inflammation. They are more plentiful when there is a marked congestion present. The erosions are usually covered with a grayish exudate. In many instances the exudate is detached leaving a purplish-red raw surface exposed. In the lower portion of the stomach the erosions usually occur on the edges of the folds, although they may be located at the base of, or between the folds. Frequently small hemorrhagic points are found along the sides and at the base of the folds. Deep seated ulcers are occasionally found at the pyloric end of the stomach. These are usually infected with secondary invaders. The walls of the stomach, especially in the vicinity of the pyloric opening, are in some instances thickened and oedematous.

Congestion of the duodenum is quite constant. It may appear diffusely throughout or in blotches. As in the fourth stomach various grades of inflammation may be present. In some instances erosion ulcers are present, and take on the same appear-

ance as those described above. Frequently the walls of the duodenum are swollen and oedematous.

The bile duct is usually congested and swollen, and, in some instances, oedematous, which may be one reason for the damming back of the bile in the gall bladder.

In some instances the jejunum and ileum are markedly congested, but the average case shows very little change except for a slight congestion.

The caecum usually shows a marked congested and hemorrhagic appearance of the mucous membrane. This appearance may be diffuse throughout the organ, or only in part.

Usually the changes are most prominent in the vicinity of the ileo-caecal valve. The congestion and hemorrhages may occur in streaks running lengthwise the organ, or they may appear as blotches. Erosions are sometimes found in this part, but are not constant. The ileo-caecal valve is frequently partly eroded, swollen, or oedematous. Peyers' patches are usually swollen and congested. In some instances the caecum is practically denuded of its epithelium, and in this case the walls appear very thin and flabby. In other instances the walls may be thickened and oedematous.

The colon is frequently congested to a more or less extent throughout its length. The congested and hemorrhagic areas may occur in either streaks or blotches. Very small erosions are frequently noticed, but one has to be very careful or they will be overlooked. In some instances the wall of the colon is thickened and oedematous.

The rectum is one of the portions of the internal tract which shows lesions very constantly. It is usually markedly congested and in many instances shows a multitude of small hemorrhagic points. The congestion and hemorrhages usually run in streaks, although it may be diffuse. Erosions are very rare in this area. One has to be careful and not confuse injuries caused by the thermometer while taking the temperature with the ulcers caused by rinderpest. Frequently the walls of the rectum are swollen and oedematous. In some instances it is practically denuded of epithelium, especially in the region adjoining the anal opening. In these cases the walls are thin and flabby, this condition being especially prominent in animals that have a relaxed anus before death.

Frequently the epithelium of the anal opening is cracked, giving it a chapped appearance. In many instances a dirty yellowish gray exudate is present around the orifice.

Erosions covered with a grayish-yellow exudate are frequently found on the lips of the vulva. Congestion is usually present around the urethral opening. The cervix is quite constantly congested.

In the male the penis is almost constantly congested. Frequently small erosions are present. The sheath is almost invariably congested, and, in some instances, to a very marked extent, often taking on a purplish red color. There is usually a thick yellowish cheesy exudate present on the glands.

Peritonitis is constantly present. The peritoneum is often coated over with a fibrinous exudate. This is especially prevalent over the region of the small intestines and fourth stomach.

SUMMARY.

1. The most constant clinical symptoms of rinderpest are: (a) rise in temperature above normal, the temperature remaining high throughout the course of the disease, or until just prior to death when it frequently drops to sub-normal; (b) a dejected appearance of the animal, lopping of ears, head lowered, eyes sensitive to light. In carabaos there is congestion of the eyes; (c) diarrhea, loss of appetite, thirst, emaciation, prostration, congestion and discharge from all mucous membranes.

2. The most constant morbid appearances, in order of frequency with which I have observed them, are: (a) peritonitis; (b) congestion and ulceration of the fourth stomach; (c) congestion of the duodenum, caecum, colon, and rectum; (d) congestion of the vagina, glands, penis, and sheath; (e) erosions in, and congestion of, the larynx; (f) congestion of the brain and spinal cord; (g) enlargement of the lymphatics especially those located in the mesentery.

From the veterinary research laboratory, Bureau of Agriculture, Alabang, Rizal, P. I.

THE NORTH TO SOUTH MOVEMENT OF ANIMALS ON THE ISLAND OF LUZON.

By Dr. STANTON YOUNGBERG, *Supervising Veterinarian.*

The Philippine Islands are an unfenced country. Thus the difficulty of regulating the movement of animals renders the control and final eradication of rinderpest from these Islands a very complex problem. What is true of the country as a whole applies especially to the Island of Luzon, with its extensive and fertile central valley in which there is a constant movement of animals in all directions with an added continual influx from the north.

The Island of Luzon is divided geographically into three parts, viz, northern, central, and southern. For the purposes of this article it is not necessary to consider the southern portion, which obtains its supply of carabao mostly from those imported into Manila or from adjacent southern islands.

Northern Luzon is cut up by three mountain ranges, running from north to south and practically paralleling each other. The Sierra Madre runs down the east coast. The Caraballos runs down a little to the west of the centre to a little above the sixteenth parallel where it merges into the Caraballos Sur which runs southeast and finally joins the Sierra Madre. Between the Sierra Madre and Caraballos lies the fertile Cagayan Valley. The Sierra de Ilocos runs along the western coast, is not as high as the other two ranges, and does not form a connected chain. The Ilocos Provinces occupy a long narrow strip between these mountains and the sea.

Central Luzon extends from Lingayen Gulf south to the Tagaytay Mountains, which are a short distance below Manila. On the west are the Zambales Mountains and on the eastern coast a continuation of the Sierra Madre. Between these two ranges lies the extensive central valley which covers more than 3,000 square miles and embraces the following provinces: the greater part of Pangasinan, Tarlac, Nueva Ecija, Pampanga, and Bulacan.

In this central valley there is a shortage of carabaos, the animals most commonly used for work purposes in this section. Two reasons can be assigned for this shortage. The completion of the lines of railway through this valley opened up large tracts of unoccupied land in Pampanga, Tarlac, and Nueva Ecija, a great deal of which is suitable for the cultivation of sugar. Thousands of acres have been and are being settled by Ilocanos from the crowded narrow strip of seacoast comprising the Provinces of Union, Ilocos Sur, and Ilocos Norte, many of whom bring their own animals. Since 1887 rinderpest has caused great losses among the carabaos and cattle of this section, carrying off every year a large number of the younger susceptible animals. This, combined with deaths from ordinary causes, and neglect of proper breeding, results in a shortage of animals even in the older well-settled districts.

The hill country of Pangasinan, which, on account of its rough mountainous character, is essentially pastoral instead of agricultural, and the Ilocos Provinces, have not been affected by rinderpest as severely as the central valley. The reason for this is that, on account of the rough nature of the country, the very poor roads, and the proximity to the sea, the majority of the products are transported by water. Therefore, no such continual intermingling of animals occurs as in the central valley. Nearly all of the arable land in these two sections is under cultivation and here more attention is paid to the breeding of animals; thus there is a surplus with which to supply the provinces farther south. The purchase price of a work carabao in these parts is from ₱90 to ₱130. In Tarlac and Nueva Ecija the selling price is from ₱110 to ₱160. Pampanga, the principal sugar province of Luzon, has the largest demand and pays the best prices; good strong males often bring ₱180. When carabao dealers come down from western Pangasinan or the Ilocos Provinces, they may dispose of a few head in Tarlac or Nueva Ecija, but the ultimate destination of the majority is Pampanga. But few of these animals reach Bulacan, as this province buys mostly from Manila.

In the early part of 1911, rinderpest became generalized throughout Pangasinan, the most important rice-producing province in the Islands. A large force of employees of the Bureau of Agriculture, assisted by the Philippine Scouts, was thrown into this province to undertake a thorough clean-up campaign. During 1910 and 1911 outbreaks of rinderpest occurred in seven municipalities of La Union. Although this disease has not been

reported from Ilocos Sur or Ilocos Norte, these provinces have not been declared clean, as the Bureau of Agriculture has not been able to dispose of sufficient additional forces to thoroughly search out this territory. Isolated outbreaks are and have been known in the Cagayan Valley for the past four years; this section is still under the necessity of importing large numbers of animals from the Ilocos country. After the completion of the Pangasinan campaign, the forces were moved southward through the central valley. Consequently, there arose the necessity of protecting this clean territory from the infected and doubtful territory to the north.

As the tide of animal traffic from the north naturally passes through Pangasinan, it was, therefore, necessary to have an adequate check on all animals coming into this province both by land and water.

The Collector of Customs had previously issued Customs Administrative Circular No. 622, regulating the transportation of live stock by vessels engaged in the coastwise trade, extracts of which are as follows:

PAR. II. No live stock shall be carried in the coastwise trade by vessels under fifteen tons gross burden, except hogs, sheep, goats, and other similar live animals.

PAR. III. Before any live stock is received for shipment by a vessel regularly licensed for the coastwise trade, or by a vessel operating without a license, the master, mate, or patron in command of such vessel shall require the person offering said live stock for shipment to present to him a certificate signed by the president, secretary, or teniente of barrio of the municipality from which shipment is made. Such certificate shall contain a description of each animal to be shipped, shall specify the kind of animals, brands, if any, point of origin and point of destination, and shall show that such animals are, to the best knowledge and belief of the officer signing the certificate, free from infectious or dangerous communicable animal diseases.

PAR. V. Upon receipt of a consignment of animals for shipment, accompanied by the above specified certificate, the master of the carrying vessel shall carry them to the port of destination specified in the certificate. Upon arrival at the port of destination, the master of the carrying vessel shall deliver, or cause to be delivered, the certificate to the municipal president and shall refuse to permit the discharge of said cattle at any other port unless said certificate is returned to him indorsed by one of the municipal officers specified in Paragraph III of this circular, of the port named therein, authorizing delivery at some other point. Upon discharging said cattle from the carrying vessel, the municipal president shall take up said certificate, indorse thereon point of delivery and date of discharge, and forward same to the nearest Collector of Customs, who, in turn, will forward it direct to the Director of Agriculture.

The provincial board of Pangasinan adopted resolution No. 495 requiring all large bovine animals brought into the province to be placed in quarantine for a period of ten days under the direction of the local Bureau of Agriculture veterinarian.

The aid of the municipal authorities was also enlisted, and they, through their municipal and barrio police, were constantly on guard for shipments of animals. To patrol the coast, inspect all shipments of animals, and assist in the proper enforcement of the above-mentioned regulations, a launch was placed on Lingayen Gulf in charge of a representative of the Bureau of Agriculture, with headquarters at Dagupan, Pangasinan. Since the inauguration of this system all shipments of animals by water destined for Pangasinan have been registered and placed in quarantine.

The roads from the Mountain Province to the lowlands were easily blocked. A trail runs from Naguilian, Union Province, over the mountains to Baguio, Benguet, and there connects with the road leading to Camp One and on into Pangasinan. The subprovince of Benguet established a quarantine on the Naguilian trail at the Ribsuan River, requiring the certificate of a veterinarian of the Bureau of Agriculture before animals would be allowed to pass. A guard was also placed on the Benguet Road at Camp One and an accurate check kept of all animals going up or coming down the road. Nueva Vizcaya has a quarantine guard on each of the three trails coming into this province, one from Isabela, one from Pangasinan, and one from Nueva Ecija. The foregoing are the only outlets through the mountains that could be used in bringing animals from the north, and they are easily guarded.

The portion of country that presented the greatest difficulties in enforcing an effective quarantine against the north was the broken and hilly strip, 12 kilometers in width, along the Pangasinan-Union boundary, between Rabon on the Lingayen Gulf and Camp One on the Benguet Road. This strip is sparsely settled and broken by numerous hills which, however, are not rugged enough to prevent the passage of animals. The topography of this section therefore precluded the possibility of maintaining an effective quarantine with guards alone. It was accordingly decided to erect a fence along this line following the Pangasinan-Union boundary as closely as natural conditions would permit.

No scheme of fencing had heretofore been tried in the Islands, hence this was essentially in the nature of an experiment. In

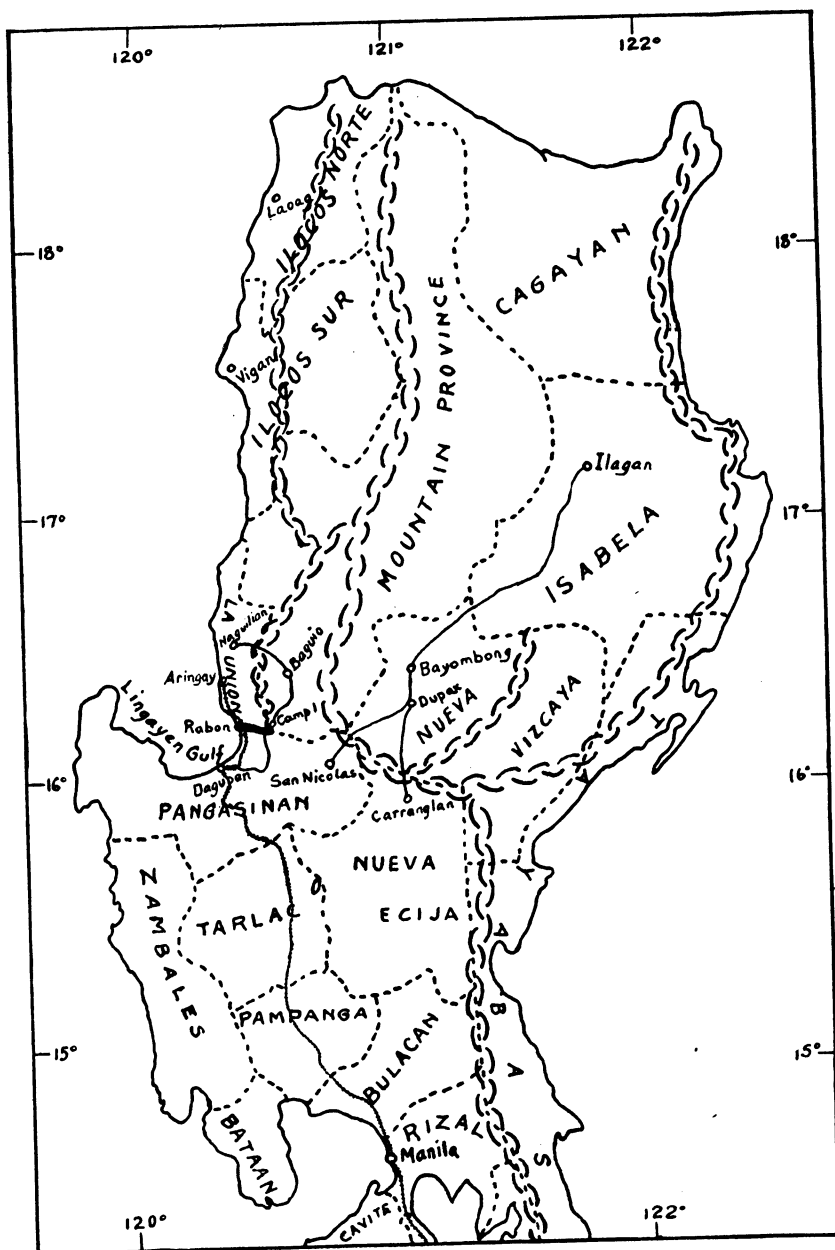


FIG. 1.—Map of Northern Luzon, showing Pangasinan-Union Fence.

view of this fact the construction of a barbed-wire fence was decided upon, which, though less of a barrier than woven wire, was cheaper, and the materials for its construction were on hand in the Islands while woven wire was not immediately available. The type of fence constructed was five-strand, of No. 12 barbed wire, posts 5 meters apart, top wire 1.6 meters high. The posts were cut on the ground, and were mostly of second group timber. On account of the number of destructive insects, and also to prevent rotting, the lower ends of the posts were covered with tar to a height of 2 feet (6.09 decimeters) above ground. Later, owing to the very considerable damage by insects, it was found necessary to tar the entire post.

The fence was erected by the Bureau of Public Works at a cost of ₱3,525.60. This included the clearing of the line, procuring and setting of 2,400 posts, constructing eight Oregon pine gates, and the transportation and stretching of 6,000 kilos of No. 12 barbed wire. Work was commenced the middle of April 1912, and the fence was turned over as complete on June 6. Owing to the fact that for the greater part of the distance the line ran through a very rough, uncultivated country covered with thick underbrush, the clearing of the right of way and the setting of the posts consumed the greater portion of the time. Outside of the two main gates, at Rabon and Camp One, respectively, six others were put in so as to interfere as little as possible with the free movement of animals owned along the line. A complete census was made of these animals, a copy of which was furnished the guards, who have authority to issue passes whenever local conditions so require. By this system no unnecessary hardships have been inflicted on the people living along the line.

The guarding and maintenance of the fence is supervised by two American inspectors—one stationed at Rabon and the other at Camp One, and each responsible for six kilometers—assisted by fourteen Filipino inspectors, who live along the line. These men work in twelve hour shifts; two have to be kept continually on duty along the beach at Rabon, which gives each of the other twelve, there being six on a shift, 2 kilometers of fence to patrol.

The annual cost of the guards is as follows:

2 Americans, at ₱1,800	₱3,600
14 Filipinos, at ₱360	5,040
Total	8,640

It was found necessary to cut a trail and erect several bamboo bridges along the line, otherwise the patrol would have been next to impossible during the rainy season. This work was performed by local laborers paid at the rate of ₱0.50 per day, the total cost being approximately ₱200. The guards attend to the ordinary maintenance, and it is necessary to hire outside labor only to repair the damages caused by heavy rains and floods. The cost of the first year's guard and maintenance will be approximately ₱9,000.

The fence was broken through three times during the first three weeks after its completion, which was, of course, during the time that the guard was being formed and drilled into shape. They were of necessity men new to that kind of work, and were also unfamiliar with the lay of the land, and unacquainted with the people along the line. Dozens of men had to be tried out as several proved to be incapable and others would quit after working a few days. During this formative period eight soldiers were obtained from the Constabulary of Union Province to assist in guarding the line. As no further attempt was made to break through the fence, after seven weeks these soldiers were relieved from duty. The guards now form a selected and well-trained force which has become thoroughly familiar with, and enjoys, the work. All animals passing through overland to the central valley are required to be sent by rail. A quarantine station is maintained at Aringay, Union, at the end of the railway, where the animals are subjected to a ten days' quarantine and are then shipped to their destination. No animals are now coming into the central valley from the Ilocos country, either by land or water, which have not undergone a ten days' quarantine period and have the proper certificates issued by a representative of the Bureau of Agriculture.

CATTLE IMPORTATION.

By DR. GEORGE S. BAKER.

There were imported into the Philippines 19,061 cattle and 10,356 carabaos from July 1, 1911, to June 30, 1912. These figures include all classes of the above animals, that is, work, beef, breeding, and dairy stock. These animals came into the Philippine Islands through the ports of Manila, Iloilo, and Cebu. The Manila importations include those landing at Sisiman, Bataan Province, as well as at Manila proper, the latter being the "port of entry" for the former. They came from the following countries: Cambodia, Australia, New Caledonia, Formosa, and the Island of Timor.

At the present time, August, 1912, Manila is the only port through which cattle and carabaos are permitted to enter the Philippines, it being the only port provided with anything like adequate quarantine facilities. It became necessary to close the ports of Iloilo and Cebu because the Government had not the equipment at either port to properly safeguard the live-stock interests of the Islands.

While restricting the landing of foreign animals to Manila adds slightly to the cost of those intended for the Visayas, this increase is more than compensated for by the lessened danger to the provincial live stock. However, there is a prospect that the situation may be remedied by the construction of a suitable quarantine station at Iloilo.

During the fiscal year ending June 30, 1912, there were landed at Manila from foreign ports, 14,066 head of live stock. Of these 11,309 were cattle and 1,906 carabaos.

Manila is provided with a fairly good quarantine station located at Pandacan and fronting on the Pasig River. Cattle and carabaos are transferred from ships in the bay to lighters and landed directly in the station. The quarantine grounds consist of about six hectares. There are fourteen concrete, tile-roofed sheds, provided with concrete mangers and water

troughs, each capable of accommodating about one hundred head of cattle. These sheds are arranged in blocks of three and are all surrounded with a five-foot wire fence with locked gates between the different blocks and in the alleyways. This permits of the separation of different shipments of live stock, and, in case disease appears, the Bureau is able to confine it to the lot affected. Six thousand five hundred and thirty-three cattle and 2,527 carabaos passed through the Pandacan quarantine station during the past fiscal year. An entrance fee of ₱0.50 per head is assessed against all animals entering the station; a charge of ₱0.10 per head, per day, is made for yardage and care; under this arrangement the station is nearly self-supporting. The owner of quarantined stock has the privilege of providing feed for his own animals and the Bureau of Agriculture prefers that he shall do this. The law, however, provides that, if the owner shall fail to feed his animals, the Director of Agriculture shall feed them and collect the cost from the owner. It has only been necessary for the Director of Agriculture to do this once or twice during the past year, the owners preferring to provide for their own stock, as a rule.

The Bureau of Agriculture maintains quite an extensive plant at Sisiman, across the bay from Manila, on the Mariveles military reservation. This plant consists of a number of corrals and a matadero, the whole having been erected at a cost of approximately ₱50,000. Only cattle from Australia are allowed to land at Sisiman, and they only for slaughter in quarantine. Practically all of the fresh unfrozen beef consumed in Manila is supplied from Sisiman. During the past fiscal year 8,104 cattle were landed and slaughtered at this point.

Now, as during the past two years, the general orders regulating cattle importation from the coast of China, require quarantine of imported animals for three months before landing in Manila. However, importers are offered the alternative of having their animals immunized in Hongkong, at their expense, by a representative of this Bureau, subject to the permission of the Government of Hongkong.

During the year past the existence of disease among cattle and carabaos in shipments from Pnum Penh, Cambodia, has necessitated the enforcement of a three months' quarantine on animals from there. Experiments with the immunization of stock from that country by simultaneous inoculation have been highly successful. Arrangements are in progress to permit the importation of cattle and carabaos from Pnum Penh, after immunization before shipment, at the importer's expense.

THE VETERINARY RESEARCH LABORATORY AT ALABANG.

By ARCHIBALD R. WARD, *Chief Veterinarian.*

First in importance in combating animal diseases, in a tropical country more particularly, is a research laboratory for the purposes of studying the diseases of live stock with a view to determining their peculiarities as a guide to the employment of measures used in combating them. In recognition of the necessity of research in connection with the field work of the veterinary division there has been a laboratory established with a staff of experts whose scientific training has fitted them for the study of the problems associated with rinderpest and surra. There are employed two veterinarians on pathological work, an entomologist and a foreman, together with the requisite staff of laborers. In order that the work of the laboratory may be closely coördinated with the field work and best serve its needs the whole is under the supervision of the chief veterinarian.

The laboratory is located at Alabang, Rizal Province, at a slight elevation and overlooks Laguna de Bay. It may be reached from Manila by rail or automobile in forty-five minutes. The main laboratory building is a modern reinforced-concrete structure, 12 by 20 meters, accommodating the laboratories of the pathologist and the veterinary entomologist, together with other features of necessity closely associated with them, like stock-room, refrigeration, records, library, dark room, centrifugal machinery, sterilizers, autoclaves, etc. The building is supplied with gasoline and acetylene gas plants.

The pathologist is provided with a private laboratory and a larger general room well supplied with laboratory furniture. Separate chambers are provided for incubator room, paraffin baths and culture room. Among the more important pieces of apparatus available are: microtomes, designed for the paraffin

method, celloidin method and freezing method; paraffin baths, incubator, centrifuge, pressure filtration apparatus, agitating machine, sensitive balances, spectroscope, hemoglobinometer and haematocrit.

The pathological laboratory is equipped with a Zeiss microscope together with accessories such as the usual varieties of oculars and objectives, camera lucida, drawing board, dark field illuminating condenser, blood counting apparatus, etc.

The veterinary entomologist is similarly provided with private office and general laboratory. An ordinary Zeiss microscope and Zeiss dissecting microscope with the usual accessories are available for use. The laboratory is equipped with the ordinary apparatus for an entomological laboratory, such as insect boxes for storage of specimens, dark closets for ecological studies, and breeding cabinets for insect culture.

The laboratory is supplied with a dark room together with photographic equipment such as Zeiss photographic microscope with stand and necessary lenses, microphotographic camera and a 5 by 7 Graflex camera for general work in live-stock studies. The library contains standard reference works on pathology and allied subjects in English and German, but emphasis is being laid on the formation of a library of periodicals for current consultation. There are received at the library about fifty periodicals in English, French, German, and Dutch covering the general field of veterinary medicine, pathology and entomology as relating to disease. It is felt that it is highly essential to have these periodicals instantly accessible to research workers in order to keep them abreast with current progress.

The equipment for the accommodation of experimental animals is most liberal. The plant was formerly used for the production of antirinderpest serum on a large scale with shed accommodation for nearly five hundred animals. When serum production was discontinued there was made available for present purposes an abundance of well-built cattle sheds with galvanized-iron roofs, cement floors, and convenient water supply.

For experiments with surra there is provided a rectangular inclosure simulating natural conditions as nearly as practicable. No roof is provided, the top of the cage being merely closed with screening. Canvas is stretched overhead in case of necessity to protect the animals within from the sun. A section is provided for the growth of plants and trees to provide the shade requirement of insects within the inclosure and a concrete water pool was built likewise for insects.

The shed is covered with brass screen eighteen meshes per inch. It contains three divisions, each with a capacity of two animals. The two end divisions are partitioned into stalls with coarse iron screen with a one-half inch mesh. The central portion is adapted to use as a detention and quarantine section to serve for either wing as occasion demands. The spacious vacant area in the center of the inclosure, entrance to which is made through a double-doored, screened vestibule, serves as a trap room for undesirable flies.

The animals in the three stalls are watered from individual troughs filled by artesian well water.

This rectangular inclosure is 18.6 meters long by 7.3 meters wide. The height is graduated from 2.4 to 3.8 meters. Each end division is 7.3 by 6.3 meters, the middle section 4.2 by 7.3 while the vestibule is 4.3 by 4.4.

It will be noted that this structure is an exceptionally large screened cage and furnishes unusual facilities for the study of insects in their relation to the transmission of disease from one animal to another. Its construction was necessitated by the fact that ordinary screened compartments under a roof are so dark that insects do not behave in a normal manner.

The veterinary entomologist is further provided with a building completely screened throughout and built with a concrete floor and galvanized-iron roof. Eight box stalls are arranged on either side of a spacious runway and have a capacity of from eight to sixteen animals. Each stall is entered through an individual vestibule also fly-screened, opening into the hallway which is screened to the roof. Facilities are provided to render contamination as negligible a quantity as possible. The attendant does not need to enter the stall to feed or water the animals as this is accomplished from the hallway by feeding through a trap door and watering is done by opening a valve on the outside, each stall being provided with a short water pipe connecting with a main pipe on the outside of the stall. The manure is removed through a small door at the bottom of the wall behind the animal.

The length of the shed is 18.6 meters, width 10.2 meters, height at either end 1.8 meters, at center 2.9 meters. The stalls are 3.9 meters in length and 3.1 in width.

There is a low coarse-screened shed for small animals with concrete floor and iron roof. This shed is 8.1 meters long, 7.1 meters wide and 2.4 meters high. In this shed there are double-

decked tables and shelves holding the animal cages, to wit—fifteen monkey cages and thirty-five cages for guinea pigs. These cages are double-screened, fly proof, with iron base holding a closely fitting removable tray. The cage is cleaned by removing the tray. A small aperture at the top of the cage with a screened cover serves as the entrance.

The quarters for the housing of animals in experimental work in connection with the study of such diseases as rinderpest are provided by an E-shaped group of sheds formerly fitted to hold two hundred animals. One wing is provided with a screened operating room with facilities for restraining animals such as stock and operating table. Six screened box stalls, with vestibules, are provided. Such accessories as abundant and convenient water supply, storage rooms for fodder, platform scales, etc., are installed. Another shed completely isolated from the main group will accommodate at one time fifty head of susceptible cattle intended for use in experimental work. In this shed likewise are kept three hundred guinea pigs and seventy-five rabbits to provide material for experimental work.

Since small animals, ordinarily used in experimental work, are not susceptible to rinderpest, an extraordinary number of cattle and carabaos are of necessity used in experimenting with this disease. For instance, during the period from November 1, 1911, to June 1, 1912, there were employed in the laboratory one hundred and thirty-six head of cattle, seventy-six carabaos, twenty-nine horses, eleven goats, four sheep, and three deer. A certain proportion of these cattle and carabaos recovered from the rinderpest and were available for sale.

The pathologist is primarily occupied with a study of the gross and minute pathological changes occurring in rinderpest. Associated with this are experiments designed to reveal the causative agent of the disease.

The entomological work of the laboratory is devoted to the study of ecological factors in connection with epidemiology of stock disease. All insects employed in experiments tending to demonstrate disease transmission are bred from egg to adult under the personal supervision of the entomologist.

Another important phase is the investigation of the most efficient insecticides in the eradication of insect pests which serve as possible carriers of disease, or are a source of annoyance, endangering the health of work animals. These investigations are conducted both extensively in the laboratory and under field conditions in nature.

Bulletins of the Bureau of Agriculture from the veterinary research laboratory:

No. 19, Experiments on the Efficiency of Antirinderpest Serum, By Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian, and Frederick Willan Wood, D. V. M., Acting Assistant Chief Veterinarian.

No. 20, The Muscular Changes Brought About by Intermuscular Injection of Calves With the Virus of Contagious Pleuropneumonia, By William Hutchins Boynton, D. V. M., Pathologist, under the direction of Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian.

No. 21, A Study of the Normal Blood of Carabao, By William Hutchins Boynton, D. V. M., Pathologist, under the direction of Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian.

No. 24, The Role of Stomoxys Calcitrans in the Transmission of Trypanosoma Evansi, by M. Bruin Mitzmain, M. S., Veterinary Entomologist, under the direction of Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian.

EMERGENCY MEASURES AGAINST RINDERPEST FOR STOCK OWNERS.

By FREDERICK WILLAN WOOD, *Supervising Veterinarian.*

It is the aim of this article to present to the live-stock owners a few suggestions to enable them to take reasonable care of their animals during an outbreak of rinderpest or during the prevalence of the disease in their immediate locality.

Rinderpest is a contagious disease of great economic importance as it attacks carabaos, cattle, sheep, goats, and deer and has a mortality of from 50 to 100 per cent. It is characterized by the appearance of the following symptoms, namely, loss of appetite, great depression, fever, and may be accompanied by a more or less profuse and sometimes bloody diarrhea.

In the Philippine Islands where rinderpest is known to exist to a greater or less extent a farmer or cattle owner should immediately, when his animals appear sick or indisposed, think of rinderpest, and proceed to take precautions to protect his herd, pending the arrival of some one having an expert knowledge of diseases to tell him whether the disease in his herd is rinderpest or something else.

The following measures are those that should be taken as soon as any sickness appears in the herd:

Separate all the animals (or tie them up individually) in secluded places at a distance of 20 meters apart. These secluded spots should be well drained and maintained as dry as possible, as it is known that rinderpest virus soon loses its vitality, if exposed to sunlight and drying. The owner of these animals should immediately notify his local municipal officials and request that the Bureau of Agriculture in Manila be notified, and the local representative of the Bureau of Agriculture should be called on in person and requested to investigate the sickness at once.

Pending the arrival of a competent diagnostician, no person should be allowed to attend more than one or two animals, and

no other species of animals should be allowed near the cattle or carabaos that are sick or have been exposed to the sickness, especial attention being given to dogs, hogs, chickens, goats, sheep, and deer, as these animals can surely carry rinderpest. In case no expert diagnostician is immediately available, place all sick animals in a corral constructed of the best available material and made impassable for the smaller domestic animals. The apparently well animals should be tied at least 20 meters apart in suitable locations, and later, if taken sick, they should be at once placed in the corral. Should no further cases of sickness occur for a period of twenty days the animals may be allowed to work, but only within the confines of the farm on which they were taken sick. During the period of temporary isolation no person except the authorized attendant should be permitted near the animals and all food and water given the animals should be placed in individual receptacles to avoid possible chances of spreading the disease. All excreta from the animals should be placed in deep holes and there well disinfected or cremated. When only a few attendants can be secured for a large group of animals, detail one person to look after the sick animals and the other attendants should take care of those that are apparently well, insisting, however, that attendants when proceeding from one animal to another shall thoroughly disinfect their feet, clothing and hands.

The corral should be constructed in the following manner:

The outer fence should be from $1\frac{1}{2}$ to $1\frac{3}{4}$ meters high and made of tightly woven pieces of split bamboo arranged in the form of a square 20 by 20 meters. In this fence there should be placed a gate with a width of $1\frac{1}{2}$ meters, this gate being made to open towards the inside of the corral. Inside the fence there should be constructed an inner corral 10 by 10 meters. The fence for the inner corral need not be made as tight as the outer fence, but should be firm and rigid so that its posts may be utilized for hitching the animals that are to be placed inside. The inner corral should have a roof made from branches of trees, sawali, or cogon grass, so that a certain amount of shade will be available for the animals. The poles that support this roof should be at least 4 meters above the surface of the ground, this precaution being taken to allow for sufficient circulation of air above the animals. In one corner of the outer corral a hole about $2\frac{1}{2}$ meters deep by 1 meter in diameter should be dug and the inner and outer corrals drained into this by a series of shallow surface ditches. This hole is also to be used as a recep-

tacle for excreta and filth that will be found from time to time in the inner corral. In case any animals should die they should not be submitted to post-mortem unless an expert on the diseases of animals is present but should be buried intact in a hole 2 meters deep, 2 meters long, and $1\frac{1}{2}$ meters wide, this hole always to be dug between the inner and outer fences of the corral.

Proper individual mangers for the feeding of the animals should be built in the inner corral. Immediately inside of the outer gate there should be placed a large can or crock in which should be placed a 5 per cent solution of creolin, and the corral attendant should be instructed to see that no people entering the corral should leave it without first thoroughly disinfecting their feet and hands. The corral attendant himself should also be required to change his clothes and to disinfect his hands and feet before leaving the corral. Corrals should always be built out in the open and as far away as possible from streams, public roads and trails.

If any of the animals become convalescent, their food should consist of the choicest green grass that is available together with corn meal and palay bran.

If rinderpest exists in the vicinity, but not on your farm, do not allow your animals to do any hauling on the public roads nor pasture or mingle with the neighboring animals. The construction of a fence around the farm is of great value, as fencing is one of the most successful measures that can be used to protect your own herd and those of your neighbors. If new animals are to be introduced from time to time into your herd always quarantine them for a period of twenty to thirty days before allowing them to mix with those that you already own.

In regard to disinfection for the food boxes, yards, corrals and attendants, such materials as creolin, carbolic acid, or whitewash should be used. If creolin is used, it should be prepared as an emulsion with water containing 1 per cent of pure creolin. Carbolic acid should be prepared in a strength of about 2 per cent, and the whitewash prepared from five pounds of unslaked lime to five gallons of water. To this whitewash 3 per cent of crude carbolic acid may be added to increase its disinfecting strength. Lime is suggested owing to its relative cheapness in the Philippines.

By reason of the fact that rinderpest spreads by animals coming into immediate contact with other animals suffering from this disease, any measures that can be taken to avoid the mixing of animals will ensure a greater protection to the various live-stock interests of these Islands.

COLLECTED NOTES ON THE INSECT TRANSMISSION OF SURRA IN CARABAOS.

By M. BRUIN MITZMAIN, *Veterinary Entomologist.*

I. THE DISPERSAL OF CARABAO LICE AND THEIR ROLE IN THE TRANSMISSION OF *TRYPANOSOMA EVANSI*.

Many workers have succeeded in transmitting *Tr. lewisi*, the trypanosome of rats, by the agent of lice, but I have not discovered in the literature any mention of a successful experiment in the transmission of the pathogenic trypanosome, *Tr. evansi*, through the medium of sucking lice.

In the investigation under discussion the host in question is a species of Indian buffalo (*Bubalus bubalis*) commonly regarded as the native carabao of the Philippine Islands. The experiment was undertaken to determine if lice from carabaos infected with surra could transmit the disease to healthy animals.

For the purpose of this test four carabaos were available. Two of these, numbers 7 and 8, had been under observation prior to the experiment for three months in screened stalls; the other two carabaos, numbers 16 and 17, were kept for six weeks in a separate shed, but not screened. Freedom from infection was ascertained by daily microscopic blood examination, taking temperature twice daily, and inoculation of two guinea pigs from the blood of each of the four carabaos. At the end of six weeks, when neither carabaos nor guinea pigs showed trypanosomes in their blood, the hosts were accepted as suitable for the purpose in view.

On December 12, 1910, one thousand lice (*Haematopinus bituberculatus*, Nitzsh) were collected from a carabao whose blood was heavily infected with trypanosomes. The lice were placed with some filter paper in five large flasks, each containing 200 lice. One lot of 200 was set aside to serve as a control; the majority of these lived for two days, but none survived after three days. Two hours after the removal of the lice from their

infected host, the first lot of 200 was placed with great care among the hairs on the body of carabao No. 8. Ten hours later another lot of 200 lice was placed in the same manner on carabao No. 7. Twenty-four hours after their removal from the infected host the contents of another flask was placed on carabao No. 16, and the next day carabao No. 17 received the last lot of 200 lice. The carabaos were segregated in fly-screned stalls, where their temperatures were noted twice daily, and their blood examined daily after the third day of the experiment.

The condition of the four carabaos remained normal until January 3, 1911, twenty-two days after the lice were introduced, when the temperature of carabao No. 8 registered 40.3 C. The blood of this carabao was carefully examined in fresh condition and in stained preparations, when one trypanosome per 50 field ($\frac{1}{12}$ obj.) was found. A guinea pig (A1) was inoculated with 3 cubic centimeters of blood from the ear of this carabao and daily blood examinations were made.

Six days later, January 9, the temperature of carabao No. 8, which had remained normal since the last rise, now registered 40.2 C. The following morning, January 10, a native horse and two guinea pigs were inoculated with blood from carabao No. 8.

After eight days' incubation trypanosomes were found in the inoculated horse. None of the test guinea pigs, however, showed organisms in their blood at this time.

The blood of guinea pig (A1) which was examined daily, did not prove positive until twenty-one days after inoculation. The other two animals inoculated at the same time as the horse, showed trypanosomes typical of surra in ten and twelve days, respectively, after inoculation with blood of carabao No. 8.

The other three carabaos, after one month, showed neither rise of temperature nor suspicious organisms in their blood. At this period guinea pigs were inoculated from the blood of the three carabaos, and examined from time to time for a period of three weeks when the experiment was abandoned.

The horse inoculated with blood from carabao No. 8 passed through the stages characteristic of surra, namely, a general emaciated condition accompanied by a ravenous appetite even while in the protracted death struggles; the appearance of oedematous swellings on breast and forelegs, beginning on the seventh day after inoculation and by the time of death, extending gradually along the abdomen. The animal died twenty-five days after inoculation. Its blood remained positive up to the time of death,

when the heart's blood was found to contain, in a hanging drop, typical trypanosomes to the extent of 40 to 50 per field.

The blood of carabao No. 8 was microscopically examined from time to time and exhibited a moderate degree of infection. The animal was alive and positive for surra on March 31, 1911, when the experiment was discontinued.

It is not to be interpreted that the parasites under discussion are regarded as a practical means of dissemination for surra, and to what extent carabao lice are a factor in the spread of the disease I am not now prepared to state. It is probable that the rôle is not an important one as the insect dies in three days or less when removed from the host. What bearing would this have in the case of an animal dying of the disease which is not common and its parasites migrating to a new host? It would be necessary for the insect to find a new host and begin its attacks within a few hours after the death of the diseased animal. I have noted in two instances of the death of a carabao, that the parasites did not change their positions on the body of the animal until the latter became quite cold, and an hour after death a large number of lice were collected from the cadaver.

One may observe that the presence of carabao lice is largely correlated with the quantity of hair on the animal. In old animals the parasites are relatively scarce since the hair is shed to a large extent and lice do not have the advantage of clinging to these natural supports or employing them as a means of fastening eggs to the body of the host. There are fewer lice on carabaos which are bathed frequently or have ready access to wallows. I believe, especially where a large number of these animals are quartered, that parasites are interchanged quite freely. An example was afforded in the stock of the Bureau of Agriculture at Alabang where a number of carabaos and cattle were confined, in quarantine, in one enclosure in such a manner as to occasionally come in contact with one another.

When these animals were examined nine of the carabaos and three of the cattle were found to harbor trypanosomes. The three cattle were Indo-Chinese bullocks which, when closely inspected, proved to be infested with lice indistinguishable from those found in large numbers on the carabao. It may be noted here that two of the infected carabaos died, and, at autopsy, presented characteristic lesions of surra.

In the case of the three Indo-Chinese bullocks it is not definitely known whether or not the infection was transmitted from the carabao through the transfer of the lice which were found feed-

ing on the cattle. Experiments to cover the point involved are now in progress.

It is deemed desirable to note the bearing of the presence of the organisms found in the body of the carabao louse. The literature on the subject indicates that the surra trypanosome has not been found in this insect. In the Report of the Philippine Commission 1903, part 2, page 452, Musgrave and Clegg, who worked with the same parasites, state in this connection that they have repeatedly performed experiments on various animals which yielded negative results, and were not able to find trypanosomes in carabao lice caught on the bodies of infected animals.

In this regard, although the writer has not succeeded in making satisfactory sections of the parasite, thousands of lice from carabaos whose blood showed trypanosomes in recent examinations, were emulsified with salt solution and observations made of hanging drop preparations. There have been found repeatedly a rather large flagellate and a round form such as has been described for a latent type of *Tr. evansi*.

Whether or not these organisms are developmental forms of the trypanosomes of surra I have not been able to decide. When inoculated into two guinea pigs the emulsion of lice failed to reproduce the disease. In this instance the infected carabao, at the time the lice were collected, was negative for trypanosomes.

In this connection, it is interesting to note that the carabao lice from an infected animal, when placed upon the bodies of two monkeys, did not transmit the disease. The monkeys were immobilized from one to two days at the outset of the experiment and some of the transferred parasites were observed to attack the strange hosts.

In the matter of the dissemination of these parasites an interesting point was presented to the notice of the writer and of sufficient importance to relate. The *Lyperosia* sp. fly, found commonly throughout the Islands, is responsible for the dispersal in nature of large numbers of these carabao lice. The first instance of this kind was noted on February 2, 1912, when a few of these flies from carabaos were collected in determining their seasonal prevalence. Attached to the leg of one of the flies was a young carabao louse. It was fastened by its claws to the fly's tibia, and its new host struggled violently to rid itself of the tenacious burden. In this manner the louse was forced to reattach itself to a less disputed perch, whence it grasped the tarsus and remained there until the death of the fly two days later.

After the first louse was observed in this unusual position more careful and systematic examinations on the body of the flies were made.

The result was that lice were found to be associated with *Lyperosia* flies on an average of one to three. In a collection of eighteen hundred flies obtained in five days six hundred and twenty lice were counted. Not more than two lice were seen on an individual fly. This average of one louse to three flies prevailed for six weeks, until the middle of March, when the *Lyperosia* flies gradually disappeared and stable-flies, *Stomoxys calcitrans* Linn, predominated in vast numbers. The louse was never found attached to the latter fly or indeed to any other species but the *Lyperosia* sp.

The parasite in question was undoubtedly the larval form of the carabao louse *H. bituberculatus*. No other species of louse was collected from carabao on which the infested flies were found.

Except to increase the number of possible carriers from the infected carabao it is thought that the lice dissemination by this method does not figure directly in disease transmission. Not one of the lice thus transported was found supplied with mammalian blood. It is suggested that attachment is made either by an error on the part of the louse mistaking the tibia of the leg of the fly for the hair of its host, or transportation is required at this stage of the pediculiid's development. An analogy to this is found in the hypopial stage of the Tyroglyphid mites wherein an attachment is found to an insect for the purpose of migration to a more suitable breeding place.

BRIEF SUMMARY.

1. The carabao louse (*Haematopinus bituberculatus* Nitzsch.) is shown to be an agent in the transmission of surra from infected to healthy carabaos.

2. The parasites failed to transmit the infection in periods of 48 hours, 24 hours, and 12 hours after removal from the infected host; but proved infectious when applied to a healthy carabao two hours after feeding on the infected host.

3. No evidence is obtained to show that the transmission is cyclic, but it is more probably purely mechanical.

4. Lice removed from infected carabao failed to reproduce the disease in guinea pigs and monkeys.

5. A species of *Lyperosia* is found in this locality to be a means of dispersal for the carabao louse.

II. AN EXPERIMENT TO DEMONSTRATE PERIODS OF NONINFECTIVITY IN CARABAOS AFFECTED WITH SURRA.

An investigation was made to determine whether the infectivity of a surra carabao is periodic, i. e., if the absence of the organism from the peripheral circulation of a surra carabao can be assumed definitely as an indication of a period of non-infectivity.

It was noticed that, when an emulsion of flies (150 *Lyperosia* sp.) which had bitten a surra carabao on a day when the disease animal was negative by blood examination, was injected into a horse and two guinea pigs there was no reaction, and at another time a lot of flies were collected from the same infected carabao during a positive period, lasting three days, when the animal injected with the fly emulsion responded with a positive reaction for surra.

There is no doubt that had blood been used in both instances in substitution for the fly emulsion the results would have been essentially unaltered. In other words, the injection of flies made immediately after feeding on an infected carabao represents, and is analogous to, a direct inoculation of blood.

In this paper I do not attempt to explain the disappearance of the trypanosomes from the peripheral circulation. It is necessary only to mention that the disappearance of the organisms from the blood of the infected carabao is coincidental with the absence of the organisms from the body of the parasitic fly found feeding at this stage.

Moreover, it is not to be expected that the specific organism will be found in the suspected agent of transmission when there is a marked protracted period of absence of the trypanosome from the blood of the infected host. It would indeed be essential that there exist a decided cycle of development of the surra trypanosome in the body of the fly. Especially applicable would this become in such cases where our records show in four surra infected carabao negative periods of more than sixty consecutive days.

This phenomenon doubtless in a large measure accounts for the negative results of experiments in attempting to transfer at certain periods the infection of surra from diseased to healthy animals by means of biting flies parasitic to both hosts.

The following table serves to illustrate the results obtained from inoculating susceptible animals with blood of carabaos suffering with surra. The condition of the blood found, when subjected to microscopic examination, is noted in various stages previous to time of withdrawal.

TABLE I.—*Periods of noninfectivity in surra carabaos.*

Infected host employed.	Condition of blood previous to time of withdrawal.		Animal inoculated guinea pig control.	Date of inoculation.	Results.
	Neg- ative for—	Posi- tive for—			
Carabao 3024 (Indo-Chinese).	<i>Days.</i>	<i>Days.</i>	American horse 24	Jan. 24, 1911	Negative.
Do.....	2	-----	Guinea pig A-13	do	Do.
Do.....	26	-----	American mule 58	Aug. 18, 1911	Do.
Do.....	10	-----	Guinea pig F-9	do	Do.
Do.....	2	-----	American mule 58	Sept. 4, 1911	Do.
			Guinea pig F-12	do	Do.
			Guinea pig G-12	Oct. 5, 1911	Positive on fourteenth day. Dead January 22, 1912.
Carabao 2647 (native).	8	-----	American mule 58	Sept. 18, 1911	Negative.
Do.....			Guinea pig G-4	do	Do.
Do.....			American mule 58	Oct. 16, 1911	Positive on sixth day. Dead November 21, 1911.
Do.....	2	-----	Guinea pig A 1-20	do	Positive on eighth day. Dead January 10, 1912.
Do.....			Guinea pig A 1-21	do	Positive on twelfth day. Dead February 14, 1912.
Carabao 2640 (native).	3	-----	American horse 35	Jan. 21, 1911	Negative.
Do.....			Guinea pig B-19	do	Do.
Do.....	1	-----	Native horse 12	Feb. 19, 1911	Positive on eighth day. Dead March 23, 1911.
Do.....			Guinea pig A-5	do	Positive on tenth day. Dead March 28, 1911.
Carabao 2645 (native).	1	-----	Guinea pig G-8	Sept. 20, 1911	Positive on twelfth day. Dead January 14, 1912.
Do.....	26	-----	Guinea pig A 1-21	Oct. 16, 1911	Negative.
Do.....			Guinea pig A 1-23	do	Do.

The practical significance of this investigation is indicated as follows:

1. During the negative stage of the disease the carabao is not a source of danger as an active focus for fly dissemination.

2. It does not become imperative to verify microscopical findings (when carefully performed) by animal inoculation in suspected cases of surra in carabaos; it is not convincing nor significant during negative periods.

3. When the trypanosome is not found during protracted stages upon microscopical examination it should not be assumed that the carabao is free from infection.

III. AN ENTOMOLOGICAL STUDY OF A SURRA OUTBREAK AMONG CARABAOS IN THE REGION OF LA CARLOTA, OCCIDENTAL NEGROS.

The following cases representing individual investigations on distinct haciendas in the region of La Carlota present themselves for study. The data gathered are as follows:

HACIENDA NO. 1.

From November 10 to one week following, 8 cases of carabao surra were found, along with 1 infected bullock and two suspected cases of carabao surra. In more or less intimate contact with these infected animals there were present 105 cattle, 115 carabaos, and 6 horses. It is worthy of note from information furnished by the owner that surra in carabaos existed on this hacienda for several years, and that animals, carabaos, cattle and horses were permitted to pasture in common freely. The 6 horses, although stabled apart, were in more or less daily contact with the carabaos, 1 of them a mare three months in foal had lived on this, its birth place, for ten years; 2 lived on the hacienda for three years; 2 for three months, and 1 for three weeks. All of the 6 horses had been carefully tested for surra and all were free from the disease.

More than 80 per cent of the flies found on animals from this hacienda were common parasites on all three species of mammals present; they were the common *Lyperosia* flies.

HACIENDA NO. 2 (OBSERVED NOVEMBER 10, 1911.)

Here were examined 90 cattle and 60 carabaos. No surra was found except in the case of a horse which had been transferred four weeks previously from a neighboring hacienda. This surra horse had been left on the hacienda under discussion for two weeks, exposed to flies in a shed within 20 feet of the corral occupied by the 150 head of cattle and carabaos. Not a single specimen of *Stomoxys* was collected from the carabaos. The flies for the most part were *Lyperosia* sp.

HACIENDA NO. 3 (OBSERVED NOVEMBER 10, 1911.)

An Indo-Chinese bull was found here within one mile of the La Carlota experiment station with a virulent infection of surra. More than 50 carabaos occupied the same pasture but were surra free. The infected animal was apparently in fair condition. Only a very few *Stomoxys* were found and the *Lyperosia*

flies hovered in a dense swarm close to the bull; they numbered approximately 1,000 to 1,500. It was also of interest to note that carabao lice were collected from this animal.

HACIENDA No. 4 (OBSERVED NOVEMBER 11, 1911).

On this hacienda 90 carabaos were examined, 4 of which were positive for surra and 8 showed clinical features of the disease. The contacts here were 2 mares, with foal, kept stabled some distance from the pasture. These dropped colts which, at the time of examination, were three and six months old; the latter were surra free. The sire, stud of the 2 mares, was found to be infected with surra. At the time it was identified the animal had been removed a mile away to a neighboring hacienda where there was no surra.

The question is, Did the horse contract surra from the infected carabao? It might have done so, but another source of infection was present, for the horse was used as a carriage horse visiting other haciendas and towns. Did it contract surra en route?

HACIENDA No. 5 (OBSERVED NOVEMBER 12, 1911).

Twenty-three cattle and 53 carabaos were examined on this hacienda. No case of surra was detected in two weekly examinations. Here was noted an almost entire absence of carabao lice. All of the carabaos were covered with slime from their wallows. The owner asserted that he kept them as much as possible in mud wallows in order to kill the lice. Only one carabao showed lice and but few of them.

Flies.—No *Tabanidæ* were seen. *Lyperosia* flies and *Stomoxys* were present, about 1 per cent only of the latter.

HACIENDA No. 6 (OBSERVED NOVEMBER 13, 1911).

One hundred and three carabaos were examined. Eight cases of carabao surra were found one week previously, and at the present examination 6 cases and about 12 suspects, i. e., showing clinical features, but no trypanosomes. Here were noted a greater number of lice than those from the previous case in which no surra was found. *Lyperosia* flies here predominated. Few *Stomoxys* were present.

HACIENDA No. 7 (OBSERVED NOVEMBER 17, 1911).

On this hacienda there was located a herd of carabaos showing, by microscopical examination, an infection of 8 per cent. The following flies were collected from five carabaos which were surra

positive on the day of inspection: *Lyperosia* flies, 341 specimens; of *Stomoxys* 7; of *Muscid* (nonbiting) 7. A vast predominance of *Lyperosia* was observable in general.

DISTRIBUTION IN GENERAL OF FLIES ON SURRA-INFECTED HACIENDAS.

Tabanidæ.—During two weeks of field observations but seven specimens of the horse flies were taken in this district. Three of these were collected while they were feeding on cattle and four males were collected on trees or sheds near the cattle.

Stomoxys.—Few *Stomoxys* were found on any host. In order of distribution in relation to host they are: Horse, cattle, carabaos.

Lyperosia.—As noted in all the cases where surra was found or suspected this fly was found remarkably predominant. On carabaos especially, they swarmed above and below on the abdomen of the animal.

The fly distribution as observed in the various haciendas is shown in Table II, below:

TABLE II.—Fly distribution.—Percentage according to host.

	Lyperosia.	Stomoxys.	Nonbiting Muscid.	Tabanids.
Cattle	70	10	20	3
Carabaos	95	3	2	—
Horses	25	70	5	—

MEANS OF TRANSPORTATION OF SURRA IN LA CARLOTA.

An animal, whether surra infected or healthy, carries with it, when traveling, as many as several hundred flies from a focus of infection. These flies remain on the animals during transportation serving as carriers from one town or one hacienda to another. The flies are observed to remain with the animal more or less persistently for a distance of several kilometers. These flies are switched off and seek new hosts while the animal is resting at its destination. The parasites in question are, in the main, species of *Lyperosia* and *Stomoxys*.

DISCUSSION OF FIELD OBSERVATIONS.

With the limited data at hand only generalizations can be pertinent. It is realized that, for a study of surra conditions to be of economical value, a period exhaustive of meteorological and other phases must be devoted to it. To be sure, observations must be made during wet season and dry, and geographical

variations considered. The present study was of only two weeks' duration, pursued for the purpose of making certain laboratory findings more comprehensive. In this matter, for instance, there is substantiated from observations in this region, that carabao lice in unusual numbers, with due consideration to other insects, influence the incidence of surra. Also, carabao lice and *Lyperosia* flies are intimately related in numbers.

The significance of this is indicated in results from experiments in which carabao lice transmit surra, and that *Lyperosia* flies are a means of dispersal of carabao lice.

It now devolves upon us to demonstrate under laboratory conditions the rôle of the *Lyperosia* sp. flies in surra transmission.

IV. THE RELATION OF LYPEROSIA sp. FLIES TO SURRA IN CARABAOS.

The following is contributed as an experimental application of observations tending to show a relation between the presence of *Lyperosia* flies and surra in carabaos. An experiment performed under laboratory conditions is herewith cited.

A fly-proof cage with a substantial fly-proof entrance, 7.3 meters by 9.1 meters, with a height of 4.5 meters graduated to 3.6 meters was so partitioned that two surra-infected carabaos and a healthy carabao could occupy adjoining stalls without bodily contact and still be exposed to the bites of flies placed in the enclosure. Two surra carabaos, Nos. 3228 and 3252, which were in advance stages of the disease, were placed on one side of the coarse-screen partition and the healthy carabao, No. 16, was selected to be exposed.

The parasites used were *Lyperosia* flies taken in the open shed from healthy work carabaos. These were transferred twice daily to the caged animals, and were placed promiscuously in the screened enclosure. The parasites attached themselves to the new hosts quite readily. In all, over 5,000 flies were employed during the course of the experiment lasting about one month, from January 12 to February 13, 1912. The healthy animal, carabao No. 16, was not removed until two weeks later, February 28, when all of the flies had disappeared.

As shown in Table III following, blood examinations of the three carabaos were made daily. Carabao No. 3228 was positive for trypanosomes upon eleven days and carabao No. 3252 was positive for an equal number of days, and, between the two carabaos, the disease was present in a fly-communicable form during eighteen days of the experiment.

TABLE III.—*Result of exposing surra carabaos and a healthy carabao to Lyperosia flies.*

Date.	Number of flies placed in the inclosure.		Trypanosome examination in carabao—		Result of fly exposure in carabao No. 16.
	A. M.	P. M.	No. 3228.	No. 3252.	
January 12, 1912	11		Positive	Positive	Negative.
January 13, 1912	170	110	do	do	Do.
January 15, 1912	122	115	do	Negative	Do.
January 16, 1912	183	87	do	do	Do.
January 17, 1912	153	106	Negative	Positive	Do.
January 19, 1912	70		Positive	do	Do.
January 22, 1912	75		Negative	do	Do.
January 23, 1912	88		do	do	Do.
January 24, 1912		20	Positive	do	Do.
January 25, 1912	40	48	Negative	do	Do.
January 26, 1912	103	230	Positive	Negative	Do.
January 27, 1912		112	Negative	do	Do.
January 28, 1912	75	40	do	do	Do.
January 29, 1912	290		do	do	Do.
January 30, 1912		120	do	do	Do.
January 31, 1912	102		Positive	do	Do.
February 2, 1912		93	Negative	do	Do.
February 3, 1912	127	445	do	Positive	Do.
February 4, 1912		339	do	do	Do.
February 5, 1912	593		do	do	Do.
February 6, 1912	432	114	do	Negative	Do.
February 7, 1912	131	262	Positive	do	Do.
February 8, 1912	138	70	do	do	Do.
February 13, 1912	131		do	do	Do.

Carabao No. 16 showed no evidence of the disease either by temperature reaction or blood inoculation when released February 28. Subsequent observation of this animal during its two months' quarantine convinced the observer that the experiment under discussion terminated negatively. A single experiment, however, does not warrant a conclusion that this species of flies is not a factor in the dissemination of surra.

Other similar experiments are in operation at the present time.

ACKNOWLEDGMENT.

I am indebted to Dr. Charles S. Banks, entomologist for the Bureau of Science, for the determination of the species of the parasites used in the experiments, recorded in the paper entitled "The Dispersal of Carabao Lice and their Rôle in the Transmission of Trypanosoma Evansi."

From the veterinary research laboratory, Bureau of Agriculture, Alabang, Rizal, P. I.

CURRENT NOTES ¹—DECEMBER.

PROGRESS OF PORTO RICO.

The annual report of the Agricultural experiment station of Porto Rico has just been issued and contains many items of interest to the residents in the Philippines considering the situation of both these countries.

The trade of Porto Rico has increased from ₱33,200,000 in 1900 to ₱157,400,000 in 1911, of which ₱80,000,000 are exports, all agricultural materials, raw or manufactured. Sugar is the leading export now. Tobacco and cigars to the value of ₱14,000,000 were exported—other manufactured products were preserved fruits, straw hats, and distilled spirits. The advance of agri-horticultural science is shown by the importation of artificial fertilizers to the value of ₱2,000,000. Steam plows are largely utilized on the large sugar estates, and the cable plow is there favored in preference to the motor truck. Coffee in Porto Rico is a crop of considerable importance but pineapples and citrus fruits are now encroaching upon the coffee.

The growth of the fruit industry in Porto Rico during the last decade is remarkable. From nothing, the fruit export has during this time grown to ₱3,600,000 during the past fiscal year, yet the fruit orchards are just coming into bearing. Very superior pomelos and oranges are produced and aside from the fresh fruit shipped to the United States several pineapple canneries are in operation there. (P. J. W.)

TRANSCAAL AGRICULTURE.

Is it any wonder that a country which produces almost 38 per cent of the world's gold output, i. e., nearly ₱1,000,000 worth *per day*, should have plenty of money (from the internal-revenue tax on mine products) for agricultural experiments? In that country, possessing but few districts which could be called even medium-grade farming lands, with its rocky pastures filled with poisonous weeds and grasses, and with only very limited areas

¹ Original notes prepared by various members of the Bureau of Agriculture.

adapted to fruit raising, we find the world's best veterinary research laboratory, as well as experiment farms and breeding stations which compare favorably with those of either Europe or America. Where the veterinarians of most countries would be obliged to confine their experiments to a few head of animals for each phase of the work, the little-known but best, at least so far as equipment goes, veterinary station at Onderstepoort, near Pretoria, can well afford to take a *small herd* instead of an individual.

Considering the perspective, therefore, it is believed the world must see in the comparatively insignificant sums of money spent on agriculture in the Philippines a vastly better opportunity for success; and it will be an interesting point to note whether that other formerly rinderpest-ridden country, which appears to be even now seriously afflicted with animal diseases, can show in the long run, better results, scientific and practical, than will be acquired from the expenditure of the meager amount allotted for agricultural investigations in the Philippines. (O. W. B.)

GOVERNMENT HELPS FARMERS.

In no other country in the world does the government lend aid to its farmers as does Denmark. The greatest energy is expended in securing the largest and most economical production of butter, bacon, and eggs. The most significant thing is that the greatest efforts are made to help the small farmer, with the result that the country is now almost wholly made up of small farms. One of the principal sources of aid is through furnishing farmers with cheap money. The government controls a series of banks. A laborer who has worked on a farm five years, and who has a character so good that two reputable farmers will certify to it, may obtain from one of these banks a loan corresponding to about ₱3,164 in Philippine currency. With this he may purchase a farm of from 1½ to 5 hectares. The amount loaned by the bank covers probably nine-tenths of the value of the farm. Experts of the government visit every farm in Denmark every eighteen days and advise with the farmers as to the best methods of handling their business. While dairying is the principal industry, swine and poultry production are highly developed. The area of Denmark is a little less than 4,000,000 hectares, as compared with 10,600,000 hectares in Luzon, and much of the land is by no means good, yet a population of 2,200,000 is supported, and the annual exports of butter, bacon, and eggs amount to ₱300,000,000.

While all of this is not applicable to the Philippines, a similar policy at least could be pursued and with great profit to all concerned. Dairying of course is not to be recommended, but swine and poultry production certainly should thrive here. There are plenty of good crops that will grow here which are adapted for feeding hogs and chickens, and both lines could be followed with profit. Horticulture, sugar cane, and rice might readily take the place of dairying. The big thought to consider is that of furnishing help to the small farmer. The large operators in any line have little need of government aid. The prosperity of the small farmer in any agricultural country is what really shows the economic condition of the country.

The policy should be to enable trustworthy men to secure small farms, and farms should mean as in Denmark, a plant ready for immediate production, including buildings, implements, and live stock, just as a factory includes all the necessary machinery for turning out a finished product. It is very doubtful if the Government as a whole could undertake any single line of work that would ultimately mean more to the Islands than this. Of course it could not be expected that the policy would show, at least not for quite a number of years, the same splendid results as are common in Denmark. The principle is absolutely sound, however, and could be applied to the Philippines. The present Department of Public Instruction, through the Bureau of Agriculture, and perhaps also the Bureau of Education, could furnish the inspectors, or, more accurately speaking, the farm advisers to aid in the upbuilding of what would be, under such a policy, the new agriculture of the Philippine Islands. (*H. T. N.*)

KAPOK IN VENEZUELA.

From the Daily Consular and Trade Reports we learn that a syndicate will soon be established at San Carlos, in the State of Zamora, Venezuela, with the object of producing wholesale quantities of first-class kapok. It is said that the plantation will be all virgin land and that one hundred laborers are now at work in the clearings. It is questionable, however, whether it is wise to put all the eggs in one basket and plant nothing but kapok on the entire estate. (*O. W. B.*)

GOVERNMENT AID TO HORTICULTURISTS IN AUSTRALIA.

A new departure in fostering an infant industry is the proposal of the governments of New South Wales and Victoria in Australia to establish vegetable and fruit-preserving factories in regions

newly opened for colonization. These factories will be operated by the departments of agriculture of their respective states, the produce handled at a moderate rate, and if the settlers desire, the factories may later be acquired and operated under coöperative management.

The colonists will also be aided by the government in the production and specialization of the fruits that are best adapted to the regions under consideration and which make a superior canned product. This Australian enterprise might well serve as a good object lesson to the Philippines. (*P. J. W.*)

HORTICULTURAL HEBETUDES.

It is generally supposed that the modern horticulturist is constantly surrounded by a mass of cold facts and monotonous methods, with no jolly jokes and never a hoax nor bit of mirthful nonsense to relieve the day's work; but there are cases which are worth telling if only to prove the fact that even in a supposedly commonplace science there are a few relieving diversions.

One of the most overworked hoaxes concerning plant work is that of the artificial feeding of squashes, melons, papayas, etc., by means of nutritive liquids; in this matter the horticulturist is from time to time instructed in the details of the method of procedure, i. e., as to the proper amount of sugar to put in the bottle which is attached by means of a (real red) rubber tube to the interior of the stem of the plant to be forced. Sometimes additional directions are suggested in the line of adding certain chemicals or nostrums to the soil about the roots or even to the hollow interior of the plant stem. But the last word *after* the laugh is that in future times the horticulturists may be able to successfully use some of these preposterous ideas.

Again, the horticulturist is sometimes cheered, in the midst of dreary routine of problems under consideration, by requests for information concerning tapioca seed, sweet potato seed, vanilla beans, cocoa beans, etc.; or his correspondent wishes to know, perhaps, how far apart mango hills should be spaced—and this is no worse a question than “what space should ketchup hills be allowed?” (for mangos are pickled young melons); but how can he convince the prospective vanilla planter that a “bean” is a pod, or rather fruit, containing scores of thousands of seeds? The wonder is that no requests, except occasional misspelled ones from students, ever come for flour seeds—for if there are

tapioca seeds there must, of course, be meal, flour, and, presumably, macaroni seeds.

Sometimes, too, the horticulturist is severely taken to task for his ignorance of certain things which to the informer are supposed to be perfectly good facts. For instance, it is amazing, of course, that he does not know that the sex of male, or non-fruited, papaya plants can be simply, cheaply, and effectively changed by the attachment of anything distinctively feminine, such as a miniature petticoat, to the trunk of the otherwise useless male plant. It is also quite doleful to think that one who rummages through province after province for new varieties of orange, lime and other fruits should overlook the "green orange of Manila" which is said to be at first yellow, and then finally, when ripe, a lovely mental green (subjectively speaking, of course)—and when the horticulturist protests against this reversion of colors, he may be told to jot down the fact that the "green Manila" orange does not have to conform to the regulations of the other members of the citrus family.

Ordinary freak ideas, such as the seeds of one fruit producing trees of another sort, are, of course, common and always will be. The average reader who runs is eagerly credulous of the tales of startling "crosses;" hybrids, for example, between apples and strawberries, as "true members of the same botanical family," excite the imagination of even the dullest, while stories of dual-purpose potato-tomato plants are getting stale—and almost true.

But what a pity it is that after all the wonderful variety of superstitions about the moon's influence upon the sprouting of seeds, growth of plants, and yield of fields, there is not some small grain of truth in the cloud of hebetudinous delusions surrounding this interesting subject! Many intelligent people are always willing to defend their beliefs in the said moon management of mundane plants; and even lumber dealers have been known to quarrel over the same matter, forgetting that it is really a question of *season* and has nothing to do with any quarter, fore or aft, of our innocent satellite. (O. W. B.)

NOTES ON VANILLA.

According to the "Chemist and Druggist," the world's production of vanilla beans for 1911 was 590 tons; of this large total 195 tons were grown in Tahiti; 145 tons in Mexico, the home of the vanilla plant; while the Comoro Islands produced 70 tons. We have heard it argued that vanilla can not be grown in the Philippines because of the inability of the native to handle

the crop and cure it. Can it be that the American and Filipino combined can not accomplish what the French and Polynesians, now the leading vanilla exporters of the world, have done in little Tahiti?

The Bureau of Agriculture in attempting to establish vanilla culture in the Philippines has successfully introduced nearly 30 lots (comprising some six species) of vanilla during the past nine months, all of which are doing well. In this connection it is interesting to note that some two or three species of vanilla are indigenous to the Philippines, two having been found recently in Mindanao by the writer; whether or not these species are of commercial value is yet unknown. They are far superior in vigor to the commercial vanilla, and will be forced into fruiting at as early a date as practicable in order to determine their value. Even if they should prove disappointing in this respect they may be of value for hybridizing with *Vanilla planifolia* with the object of infusing more vigor and hardiness into this species. (P. J. W.)

COCONUT PESTS.

While we may dolefully consider that the Philippine coconut has a discouragingly large number of pests which reduce the profits of the planter, we should always "count our blessings." To be sure, we have the ubiquitous and very injurious "uang," and the still more insidious red beetle, not to mention dozens of minor insect pests; the viciously destructive wild pigs and the wary deer which make planting in some districts practically impossible except inside of extra strong and tight woven-wire fences; crows, monkeys, rats, and even crabs, which take their heavy toll in most districts; and some seventeen distinct species of fruit bats, some of which do not confine their attention to bananas and soft-skinned fruits but actually damage the very young coconuts in their flower-clusters: but we should be sincerely thankful that we are thus far never in any province pestered with the more destructive denizens of the Bornean jungles which render the coconut planter's life less happy than it might be in our neighboring countries of that island.

For instance, the Mindanao planters never need to get up in the night to drive a herd of 4-meter-high elephants out of their young groves, nor to strive in vain to build fences against the amazingly strong and exasperatingly persistent tapirs; the heart buds of their coconuts are never eaten out over night by wandering families of bruangs, or Malayan bears; and while

we have plenty of monkeys, they are small and harmless compared with the ourang-outang.

In this connection, however, we should remember that the Bornean planters are nevertheless very liable to surpass the Philippine planters in the way of estate management and careful attention to the plants themselves—for does not adversity have its uses? (*O. W. B.*)

THE INCREASING DEMAND FOR CACAO.

The rapidly increasing demand for cacao is amply illustrated in the world's consumption of cacao which has increased from 122,526 tons in 1903 to 232,200 tons in 1911. In this connection it is interesting to know that Mexico, where the Europeans first found this "drink of the gods," as it was styled by Linné, has practically ceased to export cacao. Why does not the Philippines wake up to her opportunities as a cacao producer and exporter? (*P. J. W.*)

SYNTHETIC RUBBER.

For many years the rubber planter has dreaded and dreamed of the terrible *bête noir* of artificial rubber and while there is no immediate need for the practical planter to fear that his work is in vain it is certain that a large stock company to exploit synthetic rubber in Europe has just been floated.

By the same token synthetic rubber may not be very elastic and it may, at the present writing, be rather expensive, but the cold and rather lugubrious fact is that common corn or potato starch can be fermented so that it yields methyl alcohol (which is vulgarly known as fusel oil) and acetone, and from this first process isoprene can be obtained, which in turn, after two or three other chemical maneuvers, produces dimethylcycloöktadiene—or whatever the chemists now prefer to call it. In other words, starting with common starch at some ₱0.10 per kilo and a moderate amount of salt, lime and, of course, coal artificial rubber can be and is actually produced. (*O. W. B.*)

A NEW LIVE-STOCK INDUSTRY FOR THE PHILIPPINES.

Considerable attention has been paid during the last few years to the proposed introduction of hippopotami from Africa to the swamp-lands of the southern United States for the production of meat. During the fiscal year ending June, 1911, meat and meat products were imported into the Archipelago to the value of ₱3,103,084, exclusive of live animals—a not inconsiderable

amount, considering the total trade of the Philippines. The hippo furnishes an excellent class of meat and notwithstanding its size—2 to 4 tons live weight—it is quite harmless and of a peaceable disposition. The “lake region” of the Agusan Valley, Mindanao, would seem to be eminently well adapted for the rearing of hippos, and the writer is of the opinion that if this entire region were made into a large reservation and stocked with these animals, it could be more profitably utilized in this than in any other way, thus supplying a large quantity of excellent meat in place of that which is now imported. (*P. J. W.*)

BOOK REVIEW.

THE WORLD'S CANE-SUGAR INDUSTRY, PAST AND PRESENT.

By C. M. CONNER, *Chief, Division of Agronomy.*

Fresh from the press comes "The World's Cane-Sugar Industry, Past and Present," by H. C. Prinsen Geerligs. This book treats of history of introduction, growth of industry and present outlook for cane sugar in every country in which sugar cane has been or is now grown. It is a very valuable hand-book for the student of the cane-sugar industry.

Native methods of culture and manufacture, as followed in the various countries, are discussed more or less in detail in case they differ materially from standard methods.

Whenever possible, complete statistics are given relative to production and exportation of sugar in the various countries.

Sixteen pages are devoted to sugar production in the Philippine Islands.

This book is published by Norman Rodger, Altrincham (Manchester). The price is 12 shillings.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS— JULY, AUGUST, AND SEPTEMBER.

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars, United States currency.]

IMPORTS.

Articles.		Manila	Cebu.	Iloilo	Total.
Rice.....	(Kilos.....	67,106,102	24,016,436	13,180,811	104,303,349
	(Value.....	3,126,653	1,082,234	578,831	4,787,718
Beef cattle.....	(Numbers.....	4,707		3	4,710
	(Value.....	106,616		419	107,035
Eggs.....	(Dozens.....	976,114	364	520	976,998
	(Value.....	75,872	30	73	75,975
Sugar.....	(Kilos.....	810,838	80,082	99,708	990,628
	(Value.....	62,517	6,985	7,944	77,446
Coffee.....	(Kilos.....	324,266	9,344	4,568	338,176
	(Value.....	112,245	2,939	1,775	116,959
Cacao.....	(Kilos.....	197,286	27,143	2,646	227,075
	(Value.....	66,681	8,249	795	75,725
Raw cotton.....	(Kilos.....	142,690			142,690
	(Value.....	44,800			44,800

EXPORTS.

Hemp.....	(Kilos.....	34,527,043	11,605,781		46,132,824
	(Value.....	4,554,068	1,407,677		5,407,677
Copra.....	(Kilos.....	22,839,997	10,111,947	931,266	33,883,210
	(Value.....	2,223,566	996,250	86,205	3,306,021
Sugar.....	(Kilos.....	11,310,200	1,075,907	62,054,197	74,440,304
	(Value.....	518,479	62,485	2,793,536	3,374,500
Cigars.....	(Thousand.....	54,634			54,634
	(Value.....	922,787			922,787
Cigarettes.....	(Thousand.....	13,437			13,437
	(Value.....	16,181			16,181
Tobacco.....	(Kilos.....	3,538,894		30	3,538,924
	(Value.....	580,265		5	580,270

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

SEPTEMBER, 1912.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.		Temper - ture.	Rain-fall.	Temper - ture.	Rain-fall.	Aparri.		S. Fernando.	
	Temper - ture.	Rain-fall.	Temper - ture.	Rain-fall.					Temper - ture.	Rain-fall.	Temper - ture.	Rain-fall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	25.5	19.9	28.9	2	27.2	38.2	26.4	35.6	27.2	33.1	24.6	47.8
2	25.2	22.5	28.8		26.8	36.1	27.5	8.9	26.7		26.8	3.3
3	26.9	3.3	28.9		27.2	34.3	26.5	4.1	26	1.3	27.4	3.6
4	27.4		29		27.2		26.3	12	26.2	70.7	27.5	.3
5	28		27.6	3.8	25.9	13.4	28.2		27.5		29.2	
6	27.9		25.4	116	25.6	45.2	28.2	15	28.4		27.2	1.3
7	26	12	24.4	30.8	24.3	40.4	28.4	18.3	28.4		27.6	2.5
8	26.6		27.2		26.7		24.4	6.1	27.8		26	14.7
9	27		27.6		27.4		26.8	2.3	27.9	.8	27	1.5
10	27.3		27.5		28		27	41.1	27.5	.8	26.4	.5
11	27.3	23.9	27.9		27.4		27.2	26.7	27.3		27.8	58.2
12	26.8	8.6	28.8		28.1		29.2	4.8	27.3	6.9	26.4	49.5
13	26.7	29.8	28.8		27.5	8.8	28.4	19.3	27.2		26.6	58.7
14	26.7	.8	28.4		27.8	1.3	28.6		27	20	26.6	26.9
15	27.3	6.6	28.7	.8	27.2	12.7	27.1		27.5	32	25.7	22.6
16	27.3	1.8	27.6		26.1	43.5	29.2		26		27	8.2
17	26.8	2.3	28.1		27.8	.5	28.2		28.1		26.6	29.7
18	27.3	1	28.5		27.4		28.3	21.4	26.9	12.9	27.4	7.1
19	27.4		27.8		26.6		28.2		26.6	5.4	26.5	.5
20	27.4	2.6	27.8	.5	25.8	13.1	28.2	10.5	27.5		26.8	.5
21	27	1.8	27.9	5.3	26.6	18.5	28	.3	27.6	2.5	27.3	
22	27.5	.8	28.1		27.6		27.4	2.8	26.9	.5	27.6	16
23	27.7		27.1		27	4.8	28.2	1.3	26.8	14.3	26.8	1
24	26.6	.6	26.9		25.9	1.8	26.6		25.1	51.9	26.6	7.1
25	27.6	1.5	28.1		25.9	10.2	29.6	7.1	27.2	14.7	26.2	9.9
26	25.8	13	27.6	5.6	26.8		29.2		26.4	31.5	26.6	.3
27	27.6	1.8	27.6		26.7	17.3	26.6	9.9	25.8	151.7	25.8	22.4
28	28	.3	29.2		26.5	23.9	26		24.7	50.7	25.7	11.2
29	26.9	1.5	27.9	3.3	27.4		28.1	33.8	25.1	.5	26.8	2
30	27	3.6	28.4		27.5	5	26.2	34.2	25.6		26.4	(?)



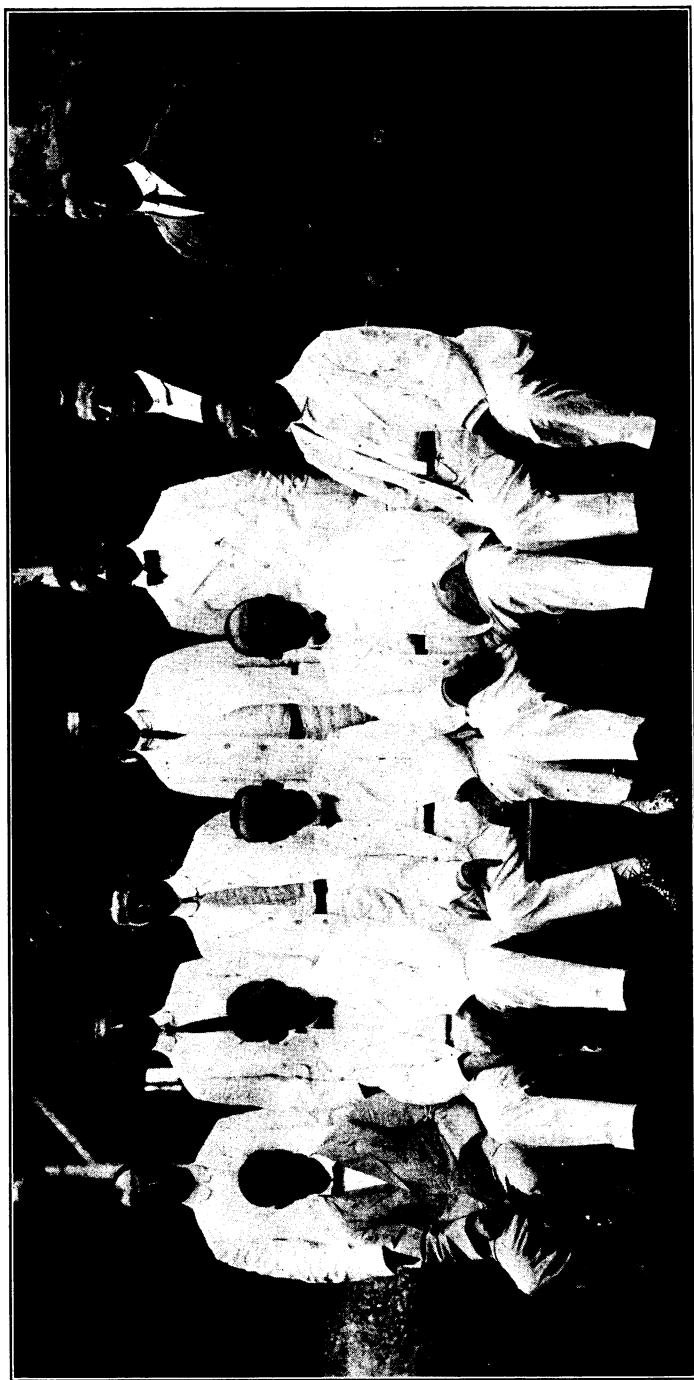


PLATE I.—BUREAU OF AGRICULTURE STAFF, 1912.

From left to right—Front row: Dr. F. C. Gearhart, Chief, Division of Animal Husbandry; H. T. Edwards, Assistant to the Director and Chief, Division of Demonstration and Extension; Frederic W. Taylor, Director of Agriculture; C. M. Conner, Chief, Division of Agronomy; Dr. A. R. Ward, Chief, Veterinary Division.
 Back row: W. E. Cobey, Chief, Clerical Division; M. M. Saleeby, Chief, Fiber Division; S. Stickney, Chief, Division of Publications; T. R. Flack, Chief, Division of Finances and Property; O. W. Barrett, Chief, Division of Horticulture; B. P. Lukens, Chief, Division of Statistics; Z. K. Miller, Chief, Division of Machinery and Construction.

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GENERAL AGRICULTURAL CONDITIONS.

The most noteworthy feature of the agricultural situation in the Philippine Islands for the year ended June 30, 1912, has been the severe and prolonged drought, which has prevailed throughout practically the entire Archipelago. The production of all of the staple crops of the Islands has been affected in a greater or less degree. The conditions that have existed, because of the drought, strongly emphasize the wisdom of the Bureau's policy of encouraging greater diversification of crops. In sections where the "one crop system" prevails the people have suffered great inconvenience, and in many instances actual want, by reason of the failure of that one crop. In other localities where secondary crops have been grown the situation has been in a large measure relieved. The crop failures of the past season have been a serious lesson to the farmers of these Islands, but it is encouraging to note that one result has been the arousing of a more general interest in regard to greater diversification of crops.

One untoward result of the long dry season has been the subsequent appearance in many localities of large swarms of locusts. Fortunately at the last session of the Philippine Legislature an act was passed providing means for combating this pest. In accordance with the provisions of this act, provincial locust boards have been appointed and the provinces requiring assistance from the General Government have been furnished funds and equipment for fighting the locusts. Up to the close of the fiscal year locust outbreaks had been reported from 74 municipalities in 15 provinces. In the majority of cases these outbreaks were promptly controlled by the provincial and municipal authorities.

The animal disease situation on June 30, 1912, showed a marked improvement over the conditions existing at the close of the previous fiscal year. The number of municipalities infected with rinderpest was reduced from 64 to 30, and of infected barrios from 170 to 69. The policy of combating rinderpest by a progressive search of territory with a concentrated force has been consistently followed. The assistance furnished by the large force of Scouts detailed on this work and by the Philippine Constabulary has been invaluable. Provincial and municipal officials have, in general, furnished effective support. The total number of reported deaths of carabaos and cattle from rinderpest for the year was 2,847. These figures are of interest when com-

pared with those of 1902, when over six hundred thousand deaths of cattle and carabaos were reported.

While all of the staple crops of the Islands have been affected in some degree by the drought, rice has suffered the most severely. Accurate figures showing the total production for the fiscal year are not as yet available, but it is roughly estimated that the crop was 40 per cent less than that of the previous year. As has been stated this shortage has resulted in increasing attention being given to the planting of secondary crops, particularly corn. It has, furthermore, directed attention to the urgent need for introducing improved methods of cultivation, for improving and utilizing existing irrigation facilities, and for constructing new irrigation works as rapidly as available funds will permit.

The banner crop of the year has been copra, and the localities where coconuts are the leading crop have enjoyed a high degree of prosperity. For the first time in the history of the Islands copra has reached the first place among export products. The phenomenal increase both in quantity and value of copra exported may be attributed both to the high prices that have prevailed, and to the increasing attention that is being given to the planting and cultivation of coconuts. The feature of the coconut industry which now most urgently calls for improvement is the introduction of better methods of drying copra. This phase of the industry is being worked out both by this Bureau and by private concerns, with promise of satisfactory results.

The exports of abacá show a small decrease in quantity and a slight increase in value over the previous fiscal year. The quality of fiber produced continues to be unsatisfactory. In localities where there is a progressive class of planters the quality of fiber produced is sufficiently high grade to bring good prices and yield satisfactory returns. In the larger part of the abacá-producing districts, however, these conditions do not prevail, and the industry is far from prosperous. The means of improving the condition of the abacá industry rest, primarily, with the planters themselves, and it is worthy of note that in the Province of Albay, the leading abacá-producing province of the Islands, a convention of the leading planters was held during the latter part of the year to consider what steps might be taken in this direction.

Although the sugar crop suffered from the drought, there has been a satisfactory increase over the preceding year both in quantity and value of exports, while the actual increase in production was considerably greater than is shown by the export

figures. Toward the close of the fiscal year sugar prices dropped to a low level, resulting in heavy losses to both merchants and planters. Appearances indicate that there will be an upward movement in prices, but it has been clearly demonstrated that the Philippine planter producing low-grade sugar is at a serious disadvantage with the more progressive sugar planters of other countries. Steps have already been taken both by capitalists and planters to establish modern "centrals" in the different sugar-producing provinces.

Owing largely to unfavorable weather conditions the production of tobacco was less than during the previous fiscal year, but there appears to have been some improvement in quality. It is probable that this improvement has been largely due to the work carried on by employees of the Bureau of Agriculture and the Bureau of Internal Revenue. These two Bureaus have been working in close coöperation in the leading tobacco-producing sections in a practical and effective way. Inspectors have traveled from town to town and have visited the tobacco planters on their farms, giving them good seed, and showing them how to grow their crop and handle the product.

The partial failure of the rice crop has resulted in a large increase in corn planting in many provinces. The corn crop of last year suffered seriously in many sections from the drought, but there is every indication that the crop of the fiscal year 1913 will be the largest in the history of the Islands. The importance of developing an increased interest in this valuable cereal, which can be grown to advantage in all parts of the Islands, can hardly be overestimated. The Bureau of Agriculture is carrying on a series of coöperative field demonstrations with corn throughout several of the leading corn-producing provinces, and recently the Bureau of Education has started a corn-growing campaign, which will cover the entire Islands.

In brief, the results of the fiscal year 1912 all point in one direction, viz., that the Philippine farmers must introduce improved agricultural methods. The potential wealth of the Islands is not sufficient to offset obsolete methods of crop production. Other agricultural countries, with which the Philippine farmer must compete, are advancing each year. Droughts, pests and diseases have been met and overcome in all parts of the world; scanty crops and inferior products must ultimately be attributed to faulty methods. There has been marked progress during the past year, even under the most trying conditions, and improvements are being gradually introduced. As the results

obtained by these improved methods become more widely known and understood, it is reasonable to believe that there will be even more rapid progress.

BUREAU OF AGRICULTURE ORGANIZATION AND SCOPE OF WORK.

During the latter part of the fiscal year, 1912, the Bureau of Agriculture was reorganized. The following organization was provided for to become effective July 1, 1912:

Director of Agriculture.

Assistant Director.

Assistant to the Director.

DIVISIONS.

Clerical division.

Division of finances and property.

Division of animal husbandry.

Veterinary division.

Division of agronomy.

Division of horticulture.

Fiber division.

Demonstration and extension division.

Division of publications.

Division of statistics.

Division of machinery and construction.

This report is prepared on the basis of this new organization as the greater part of the work of the Bureau was carried on under this organization during the second half of the fiscal year 1912.

The Bureau of Agriculture as now organized is in a position to carry on effectively the work for which it was established. The entire operations of the Bureau have been divided into clearly defined lines of work, the organization and administration of each being placed under a division chief who is responsible both for the expenditures of his division and for results obtained. Every effort has been made to give each employee certain definite duties and responsibilities and to develop at the same time the idea of coöperative effort among the different divisions. In planning the present organization special attention has been given to the questions of economical administration and business efficiency. The Bureau is primarily a business organization and to produce satisfactory results must be conducted as such. The amount of work to be done by the Bureau of Agriculture in connection with the development of agricultural industries of

these Islands is enormous and the funds available for this work are necessarily limited. Under these conditions an economical administration of the Bureau is essential.

It is believed that the work of first importance which the Bureau now has in hand is the complete eradication of rinderpest from the Islands. For a number of years various other important lines of work have been in a measure neglected in order that more funds might be available for the animal-disease campaign. This policy has been justified by existing conditions and will be continued. In close correlation with the work of eradicating animal diseases is that of animal husbandry—the building up once again of the herds that have been in a large measure destroyed by disease. A liberal allowance of funds has been made for this work and it will be actively pushed.

Of only secondary importance to the live-stock industry is the question of devising and developing means for transmitting to the farmers of the Islands the results of the work of this Bureau in such an effective way that this information will be used in producing larger and better crops. Fortunately this problem has been in a large measure already worked out by the United States Department of Agriculture. The value of coöperative field demonstrations is now fully understood and conditions in the Philippines are particularly favorable for the establishment of this work. The Bureau already has two flourishing demonstration projects and others are in process of organization. Arrangements have been perfected for starting in the Province of Iloilo the first coöperative demonstration station. It is believed that the ultimate end in view should be the establishment of a demonstration station in each province in the Islands, thereby bringing home to the people in a practical way the work of the Bureau.

The importance of greater diversification of crops has already been mentioned. In all parts of the Islands we find not only entire farms but entire communities in which but one crop of any importance is cultivated. When this crop fails the results are disastrous. A special feature of the work of this Bureau will be the encouragement of crop diversification and especially the more general cultivation of the best fruits and garden vegetables. Citrus fruits, mangos, papayas, different varieties of beans and numerous other fruits and vegetables can be grown throughout the Islands. These secondary crops can be cultivated on any farm with but little additional labor and expense. They will constitute not only a highly valuable addition to the present

food supply of the people, but will also furnish a very considerable source of income.

PROJECT SYSTEM.

During the latter part of the fiscal year 1912 arrangements were perfected for placing the entire work of the Bureau under a project system. The principal advantage of this system is that it provides a means for carrying on without interruption important lines of work regardless of changes that may take place in personnel. It also furnishes a means whereby a definite allotment of funds can be made to each line of work and detailed records kept of this work. Each project is prepared according to a prescribed form, including an *outline* and *history* of the project and providing for a *record* of future operations. The total expenditure authorized for the projects of a division constitutes the allotment of funds to that division.

A project, having been approved, will not be discontinued or the methods of procedure materially changed without the written approval of the Director. No new lines of work involving the expenditure of funds of sufficient importance to constitute a separate project will be started until prepared in project form and approved by the Director. On July 1, 1912, the division of finances and property will open an account with each project of the Bureau. The project will be credited with its allotment and will be charged with all expenditures pertaining to it.

The following table shows the number of projects authorized on July 1, 1912:

Bureau of Agriculture projects, July 1, 1912.

Executive	1
Clerical division	1
Division of finances and property.....	1
Division of animal husbandry.....	13
Veterinary division	7
Division of agronomy	7
Division of horticulture	20
Fiber division	7
Demonstration and extension division.....	6
Division of publications	5
Division of statistics	1
Division of machinery and construction.....	5
Total	74

PERSONNEL.

The former Director of Agriculture, Dr. George E. Nesom, resigned on September 13, 1911. Mr. Frederic W. Taylor was nominated and commissioned Director of Agriculture on October

1, 1911. During the interim Mr. H. T. Edwards, Assistant to the Director, was in charge of the work of the Bureau.

During the fiscal year twenty-one Americans have been appointed to classified positions and twenty have been separated by resignation and transfer, a net increase of one. Thirty-four Filipinos have been appointed to classified positions and twelve have been separated by resignation and transfer, a net increase of twenty-two.

The number of temporary employees in the service during the year was slightly in excess of that of the previous year.

CLERICAL DIVISION.

The clerical division receives, records and dispatches all correspondence of the central office, handles all matters pertaining to the Civil Service status of employees, provides and issues transportation for the central office, and exercises supervision over all matters pertaining to the general administration of the central office.

With the increase in the personnel of the Bureau, and the expansion of its field of operations, the clerical division has experienced a proportionate increment in the volume of its work. The total number of communications handled by this division during the year has been approximately 45,000, or 30 per cent more than during the previous fiscal year. The strict responsibility imposed upon division chiefs for the correctness of all transactions, clerical as well as technical, has resulted in a noteworthy improvement in manner, style and form of preparing and coursing official correspondence.

The problem of supplying satisfactory transportation to officials and employees of the Bureau, for use in transacting business in and about Manila, has been difficult. During the year two automobiles, three calesas, one two-horse delivery wagon and one carretela have been in use.

DIVISION OF FINANCES AND PROPERTY.

The division of finances and property handles all work of the Bureau pertaining to financial and property transactions. This work includes the financial and property accounting, the preparation of financial and property statements, the receipt of all funds paid to the Bureau, the auditing and payment of all accounts, and the purchase, care of, transfer, shipment and final disposition of all property.

Owing to the large field force which the Bureau maintains, the question of satisfactorily regulating the expense accounts of its

field employees is an important one. On May 21, 1912, a special order covering this subject was issued. This order provides for a more equitable system governing the payment of travelling expenses than existed heretofore in the Bureau, and its enforcement will also result in a material reduction in expenditures.

The general system of accounting has remained unchanged during the year. The methods of handling and auditing expense accounts have been improved, and a new system of recording all outstanding liabilities of the Bureau has been introduced. The fact that this division is now well organized will contribute materially to the satisfactory business administration of the Bureau.

DIVISION OF ANIMAL HUSBANDRY.

This division has general supervision of all live stock of the Bureau, and of animal-husbandry work carried on at the different stations and farms. It purchases all live stock required by other branches of the Civil Government, with the exception of animals purchased outside the Philippine Islands; makes the necessary arrangements for live-stock exhibits; and carries on public live-stock breeding, both in the provinces and on the farms of the Bureau.

PUBLIC LIVE-STOCK BREEDING.

Stallions have been available for use of the public in fifteen provinces and subprovinces, a total of 695 mares having been bred.

During the entire year stallions, bulls, boars and billies were available for the use of the public both at the Alabang stock farm and at the La Carlota experiment station. A stallion and two bulls have been kept at the Trinidad stock farm, and a stallion at the Iloilo quarantine station. During the greater part of the year one or more stallions and a boar have been available at the Singalong experiment station. In October, 1911, a native stallion, a Nellore bull and a Berkshire boar were sent to the Ilagan tobacco station. Later in the year the native stallion was sold to the Province of Isabela, and an American stallion was sent to this station.

The breeding animals maintained by the Bureau for the use of the public have been more satisfactorily distributed and handled than during any previous year. The use of these animals, while not as general as might be desired, is on the increase; and in certain sections, where the Bureau has maintained breeding animals for a considerable length of time, there is already a noticeable improvement in the live stock.

PURCHASE AND SALE OF ANIMALS.

Fifty-three requisitions for animals were received and filled during the year. Four hundred and thirty-one animals were purchased at a cost of ₱38,131.20. Six hundred and eighty-eight animals were sold for ₱49,687.46.

LIVE-STOCK EXHIBITS.

The largest live stock and poultry show ever seen in the Philippine Islands was held in connection with the First Philippine Exposition at Manila, during the month of February, 1912. This show was one of the important features of the Exposition and attracted widespread attention.

The first provincial live-stock show to be held in the Islands occurred at Virac, Catanduanes, Province of Albay, in July, 1911. This show was organized and managed by Mr. E. H. Koert, an employee of this Bureau who is in charge of live stock breeding in Catanduanes, and was very successful.

At the Iloilo Fair, held in Iloilo during December, 1911, Bureau of Agriculture live stock from the La Carlota experiment station was exhibited.

ALABANG STOCK FARM.

The condition of this farm has been materially improved during the year and at the same time the cost of its management has been reduced.

The labor supply at Alabang has not been entirely satisfactory. It has been possible to secure enough labor at nearly all times, but it has been difficult to keep good men after they have been trained, due to the demand for this class of labor and the fact that private parties will pay more than the farm can afford to give. The building of additional houses for the laborers on the farm would help the situation considerably.

One thousand four hundred and eighty-five meters of road were built during the year. Six hundred and fifty meters of this is a first-class road according to the specifications of the Bureau of Public Works. Eight hundred and eighty meters of road were repaired. One five-meter bridge and two small culverts were built. A reinforced-concrete silo, having a capacity of 100 tons, was constructed. A horse stable was constructed of material from the old guinea-pig and rabbit building. A horse shed was also built in the "Marilao" pasture. The manufacturing of cement posts was carried on quite extensively. These posts were made primarily for use on the farm, but secondarily as an experiment and for demonstration purposes.

In all 1,170 posts were made. They have proven, thus far, to be very satisfactory and the cost is less than for hard-wood posts. Thirteen houses for laborers were built during the year.

Approximately 50 hectares of land were under cultivation during the year. The larger part of this area was utilized in growing forage crops for the feeding of the farm and laboratory animals. Three hundred and nineteen thousand, nine hundred and fifty-two kilos of forage were furnished to the Research Laboratory and 826,324 kilos were fed to the farm animals. Guinea grass and the sorghums constituted the larger part of the green feed produced. Special attention was paid to the production of hay, and, although the work was entirely experimental, the results were very gratifying. Rhodes grass has proven to be by far the best grass yet grown for hay. Twelve tons of fine Rhodes-grass hay was grown, cured and baled. Over seventy varieties of grasses, sorghums, sugar cane, kafir corn, *Stizolobium*, peas, beans, corn and peanuts were planted.

The general condition of the horses continues to be satisfactory, more so than during the previous fiscal year. There have been but one or two deaths from sickness during the entire year. This improvement may properly be attributed to the better housing and general care which the animals now receive. No severe outbreak of any communicable disease has spread among the horses at this farm during the year, with the exception of a mild form of influenza which affected the colts from Baguio.

The cattle herds still continue to do well in spite of the long and severe drought which occurred this year. The pasturage became so poor that it was necessary to run the herd of Chinese cattle and Chinese crosses in the hills back of the farm. Good results have been had from the Chinese cattle and their crosses. They are unquestionably the best work animals that we possess, and they subsist on the natural range grasses which are found on the open range.

The Indian herd has continued to do well. These animals have proven to be much better foragers than was expected. Owing to their roving disposition it was impossible to pasture them in the hills during the dry season as was done with the more gentle Chinese cattle. The position of the Indian cattle as draft animals is assured. In all kinds of hauling they are far superior to the Chinese cattle, owing to their size, weight and length of leg. On the other hand they do not equal the Chinese bull for plowing as they are of a somewhat sulky disposition. In wagon teams they are unsurpassed.

The Hereford herd is in good condition. The Spanish cows are getting old and within the next two years many of them will have to be sold.

A number of the pigs at this farm have been affected by the so-called "kidney worm," which was undoubtedly imported from Australia in pigs received from there. Otherwise the pigs have remained in good condition. The demand for young pigs far exceeds our available supply. It is intended, therefore, during the coming year to increase the breeding herd to thirty sows. With this number on hand the supply of pigs available for sale should about equal the demand.

TRINIDAD STOCK FARM.

In the last annual report of this Bureau attention was invited to the fact that, due to the high cost of transporting feed from Manila to Baguio and the impossibility of raising any considerable amount of feed at the Trinidad farm, the horses should be removed from Trinidad. In July the Camp One-Baguio Road went out at a time when the Trinidad farm was practically without feed. This made it imperative that the horses be removed at once. All the horses on the farm, with exception of three—sixty-one head in all—were transferred from Trinidad to the Alabang stock farm via San Fernando, La Union, where three stallions were left for breeding work in that province. The removal of the horses has made it possible to reduce the expenses of this station very materially. During the latter part of the year only two laborers were employed.

There is very little ground at the Trinidad stock farm suitable for cultivation. Near the close of the fiscal year about three-fourths of a hectare was planted to oats and sorghum for hay, and a small plot was sown with Italian rye grass, Japanese clover and Colorado grass. The paspalum grass, which was set out in 1910, did well throughout the year and where planted in the pastures it excluded other grasses and weeds.

Seven horses and thirty-seven cattle were born at this station during the year. Eighteen cattle were sold. At the close of the year the live stock on hand consisted of four horses and ninety-five cattle.

LA CARLOTA EXPERIMENT STATION.

The cattle at this station did exceptionally well throughout the year, subsisting exclusively on the native grass, keeping in good condition and breeding well.

The horses improved considerably, though in poor condition at the beginning of the year. The goats did only fairly well. The swine did well until the latter part of the year, when they began dying of tuberculosis. The following number of animals were born:

Horses	10
Cattle	39
Carabaos	7
Goats	9
Swine	12

The following number of animals were sold:

Horses	22
Cattle	30
Carabaos	8
Goats	4
Swine	6

LAMAO EXPERIMENT STATION.

During September, 1911, fifteen goats and six burros were sent to this station and in March, 1912, three sheep were sent there. The goats had been dying from an unidentified disease since their importation. It was hoped that a change of location might arrest the disease, but they continued to die until only four were left. The burros have done very well.

ILAGAN TOBACCO STATION.

The plan of establishing a breeding station in connection with the tobacco work at Ilagan was authorized early in the year but no stock was sent to this station until October. The native stallion sent to Ilagan in October was later sold to the Province of Isabela and was replaced by an American stallion. This station has also been furnished a Nellore, bull, a Berkshire boar and three Berkshire sows.

VETERINARY DIVISION.

PERSONNEL.

At the beginning of the fiscal year 1912, there were on duty 42 veterinarians, 56 American live-stock inspectors, 300 Filipino live-stock inspectors, 1 pathologist (veterinarian), 1 veterinary entomologist, 4 American clerks and stenographers and 2 Filipino clerks and stenographers. On June 30, 1912, there were on duty 41 veterinarians, 64 American live-stock inspectors, 223 Filipino live-stock inspectors, the number of other employees remaining as at the beginning of the year. During the fiscal

year 11 veterinarians resigned and 10 were granted leave for the purpose of visiting the United States; 4 of these returned and 6 are still on leave. There were 10 veterinarians appointed during the year.

FIELD WORK.

During the year the policy of concentrating effort upon rinderpest has been continued even more persistently than in the previous year.

Rinderpest.—The policy of combating rinderpest by a progressive search of territory with the concentrated force of Scouts and Bureau employees which was inaugurated during the previous year has been consistently followed. The movement of this large force has continued southward from Pangasinan through Nueva Ecija, Tarlac, Pampanga and Bataan. At present the force is located in southern Pampanga and northern Bulacan.

The possibility of reinfesting the Province of Pangasinan by animals from the northern part of Luzon has been consistently kept in mind. Scouts have been kept on patrol on the border of the Province of La Union for a long period, and a fence has been constructed from Camp One to Rabon and patrolled by employees of the Bureau of Agriculture. The launch *Macabebe* was on patrol duty on the Lingayen Gulf for several months for the purpose of intercepting the illegal movement of animals by water into Pangasinan. The work has had the hearty support of the provincial officials of Pangasinan and has been remarkably successful. In spite of all efforts several towns in Pangasinan have been infected by animals which subsequent investigation proved to have come overland from the north, but the evidence at hand indicates that the infection thus introduced is being stamped out.

Scouts were employed, early in the fiscal year, in Occidental Negros and Cebu with decisively successful results in the territory occupied. During the last month of the fiscal year the re-infection of the Island of Panay by cattle imported from French Indo-China necessitated the employment of Scouts in that territory.

On the last day of the past fiscal year there were on duty 30 officers and 1,390 enlisted men belonging to 13 companies from the Fifth, Seventh, and Ninth Battalions of the Philippine Scouts.

The importance of Philippine Scouts in the rinderpest campaign cannot be overstated, for their employment is absolutely essential in carrying on the work. The enthusiasm, helpfulness,

patience and tact of the officers have been a potent factor in producing the result achieved during the year.

The Philippine Constabulary has aided the Bureau of Agriculture, in minor outbreaks at various places throughout the Islands, to the fullest extent consistent with the size of the organization and its other multifarious routine duties. The attitude of the Constabulary has been exceedingly helpful.

On the last day of the fiscal year there were on duty 6 officers and 147 enlisted men, belonging to the Philippine Constabulary, this force being located in the Provinces of Iloilo, Zambales, Laguna and Rizal.

During the year field men have reported 4,312 new cases of rinderpest among cattle and carabaos with 2,847 deaths. The distribution of these by quarters is shown in Table I below:

TABLE I.—*New cases and deaths per quarter.*

	New cases.	Deaths.
First quarter	1,276	937
Second quarter	1,240	827
Third quarter	997	559
Fourth quarter	799	524

The census of the Philippine Islands for 1903 contains the statement that 629,176 cattle and carabaos died during the year 1902, chiefly from rinderpest.

The known amount of rinderpest infection at the beginning and at the end of the fiscal year and the number of political divisions involved are shown in Table II.

TABLE II.—*Rinderpest statistics, beginning and end of fiscal year.*

Week ending—	New cases per week. ^a	Deaths per week. ^a	Provinces infected.	Municipalities infected.	Barrios infected.
July 1, 1911.....	254	230	17	64	170
June 29, 1912.....	23	19	11	34	69

^a Cattle and carabaos.

The distribution and amount of rinderpest found during the last eight days of the fiscal year is shown in Table III. Under the heading "Suspects" are included those animals in which diagnosis had not been confirmed and which were under observation. "New cases" included all rinderpest cases placed in the corrals during the period. "Convalescents" include all that had been in the corrals over eight days. The table does not contain data for Surigao, Isabela nor the Mountain Province, of which information is not yet at hand. The last report available shows one municipality in each to be infected.

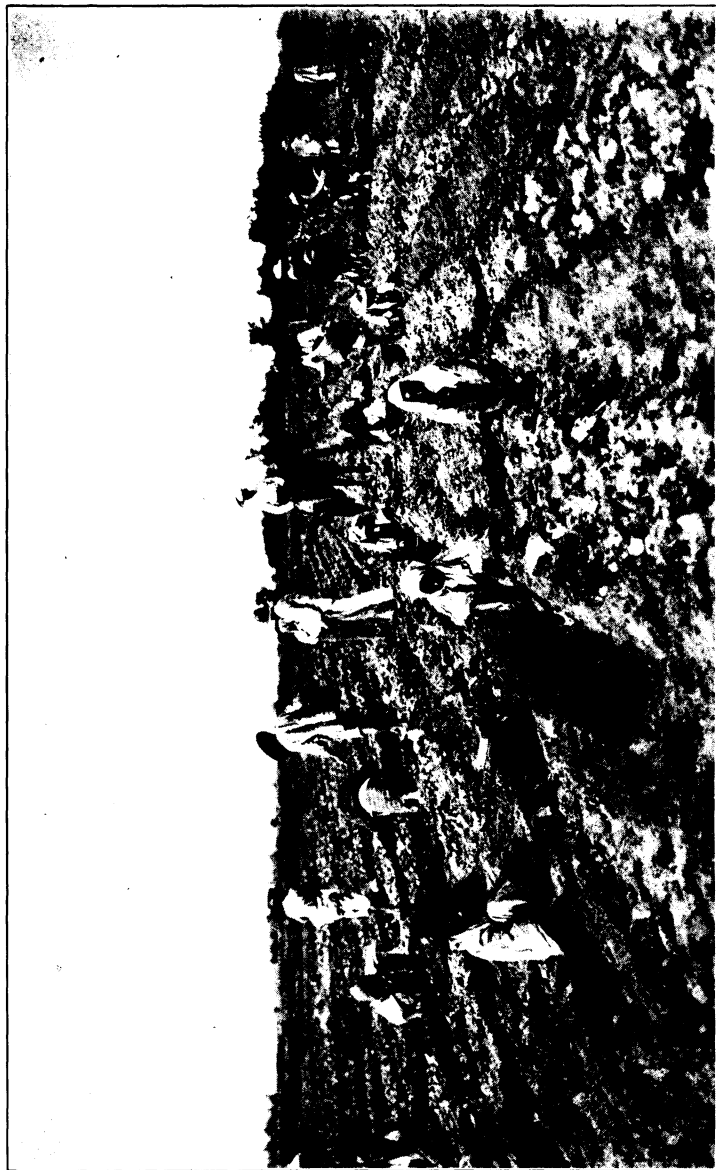


PLATE II.—PLOWING AND PLANTING SUGARCANE, HACIENDA SAN ESTEBAN, MALINGI, BAGO, OCCIDENTAL NEGROS,
FEBRUARY, 1909.

(Photo by Mr. Walker.)

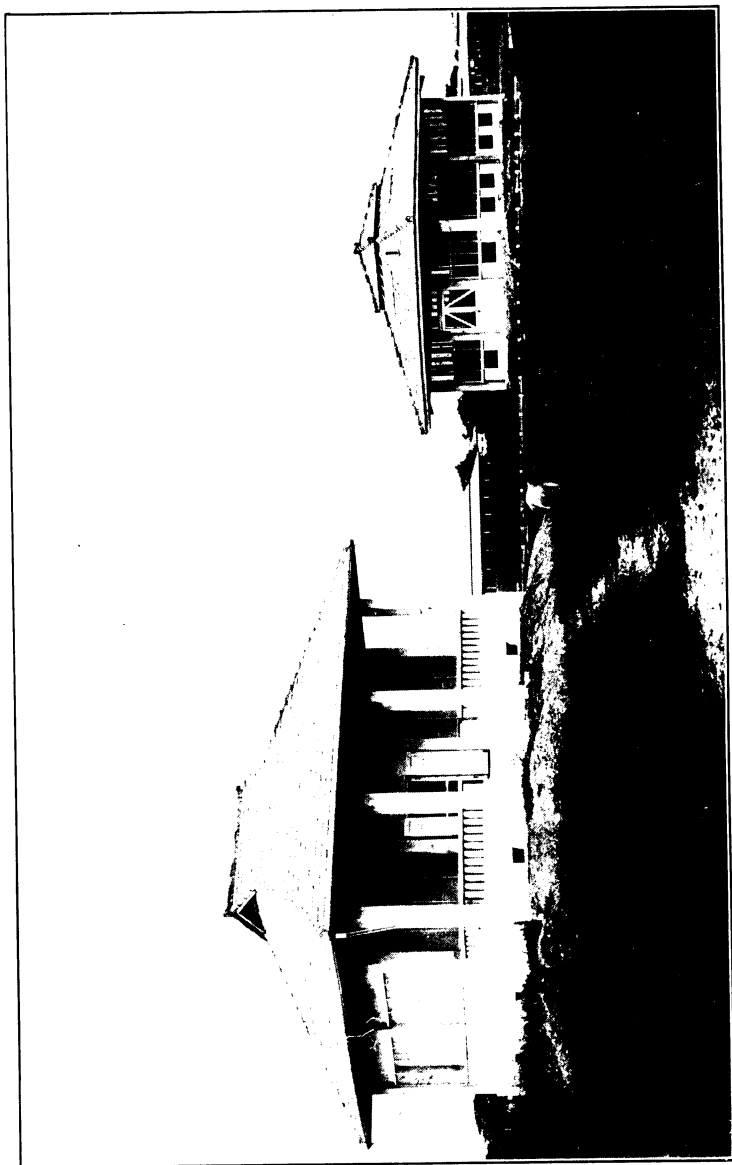


PLATE III.—VETERINARY SCHOOL AND STABLES AT PANDACAN, MANILA.

Tables Nos. 15 and 16 (Appendix) show the distribution of rinderpest cases and deaths. The total deaths from rinderpest in Table No. 15 fall short by eighty-one of equaling the deaths reported in Table I. This is due to the fact that these latter figures contain early reports by wire from certain outbreaks before regular weekly reports were begun.

TABLE III.—*Rinderpest during last eight days of fiscal year.*

Provinces.	Suspects.		New cases.		Convalescents		Deaths.	
	Cattle.	Cara-baos.	Cattle.	Cara-baos.	Cattle.	Cara-baos.	Cattle.	Cara-baos.
Pangasinan		5		6		5		1
Zambales		5		2		4		2
Pampanga		6		9		3		5
Rizal		9		5		7		2
Laguna		3		2		13		2
Capiz				1		4		1
Iloilo		3		3		20		7
Total		31		23		56		20

The figures in the two preceding tables show that the known rinderpest infection is far from being a serious factor in animal industry at the present time. The main task before us at present is that of attempting to extinguish the last vestiges of infection.

Foot-and-mouth Disease.—There have been a number of outbreaks of this disease among animals imported from Indo-China and among native animals exposed to the disease by them. The principal trouble arising from this disease has occurred in Occidental Negros where the disease is believed to have been stamped out. (See Table No. 15.)

Scabies in Carabao.—During March, 1912, scabies, or mange, was discovered in a shipment of carabao received at Manila from Formosa. This was identified as the sarcoptic variety, a type of the disease which, so far as known, had never been introduced into the Philippines before, and one particularly difficult to eradicate, owing to the habit of the sarcoptic mites of burrowing into the deeper portions of the skin. Prompt and vigorous measures were taken and the 82 carabaos affected were released after two weeks had elapsed from the last date on which live mites were found.

Contagious Pleuropneumonia.—No cases of this disease have been encountered outside of Sisiman abattoir. This fact indicates that the precautions taken during the preceding year were successful in averting the infection of the Islands by Australian cattle landed in Manila.

Miscellaneous Diseases.—The work on surra, glanders, anthrax,

rabies and hemorrhagic septicemia has been too limited in extent to call for a detailed report, other than Tables Nos. 15 and 16 (Appendix).

RESEARCH WORK.

Research work, chiefly aimed at the solution of problems associated with rinderpest and surra, has been carried out during the year at the Veterinary Research Laboratory at Alabang. The following bulletins have been published:

Bulletin No. 19, "Experiments on the Efficiency of Anti-rinderpest Serum," by Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian, and Frederick Willan Wood, D. V. M., Acting Assistant Chief Veterinarian.

Bulletin No. 20, "The Muscular Changes Brought About by Intermuscular Injection of Calves with the Virus of Contagious Pleuropneumonia," by William Hutchins Boynton, D. V. M., Pathologist, under the direction of Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian.

Bulletin No. 21, "A Study of the Normal Blood of Carabao," by William Hutchins Boynton, D. V. M., Pathologist, under the direction of Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian.

QUARANTINE SERVICE.

The general order providing for a ninety-day quarantine on cattle brought from the ports of China has been kept in force throughout the year.

Foot-and-mouth disease has been introduced in cattle and carabaos from French Indo-China at various times during the year. In April rinderpest was discovered among Indo-China cattle in quarantine at Manila and Iloilo. Subsequently outbreaks of the disease were discovered in the Provinces of Rizal and Laguna directly traceable to Indo-China cattle. Outbreaks of rinderpest in the Provinces of Iloilo and Capiz also occurred under conditions making it practically certain that the imported animals were the source of infection.

These animals had been passed by a veterinarian of the Bureau of Agriculture in Indo-China, by a French veterinarian there, and besides had undergone ten days quarantine in the Philippines. In spite of these precautions rinderpest was introduced and nothing remained but to put in effect a ninety-day quarantine on shipments of cattle from this territory. General Order No. 8, series 1911-12, dated June 25, 1912, provides for the landing of animals from French Indo-China in Manila, only, and only after quarantine for three months on lighters in Manila Bay.

Manila.—There is provided a fairly good quarantine station at Pandacan on the Pasig River. Imported cattle and carabao

are transferred from boats to lighters in the bay and landed directly at the station. Woven wire fencing with gates has been installed, dividing the quarantine station into blocks which has materially increased the efficiency of the plant, making it possible to effectually separate the different lots on arrival and to prevent contact while in the station.

The two sheds originally intended for a matadero have been transformed into quarantine sheds except for a small portion of one which has been left for the slaughter of such crippled animals as are unable to walk to the Manila matadero, it not being considered that a quarantine station is the proper place to maintain a general slaughtering establishment.

The policy of using Pandacan as a cattle depot has been changed; no stock is now permitted to be sold while in quarantine. The building of the fence and the placing of the guards at the entrances have made it possible to effectually exclude the dealers. No one is now allowed to enter the station except the caretakers, the superintendent, veterinarians and the agent of the owners. As soon as stock is released from quarantine, the owners are required to remove their animals from the station.

The importation of cattle and carabao quarantined at Pandacan has been limited to French Indo-China, Formosa, and one small shipment from the Island of Timor. One shipment of cattle from New Caledonia was held in quarantine, pending slaughter, in the owner's corral in Manila.

Iloilo.—The present quarantine facilities at this port are entirely inadequate. The grounds are located a long distance from the water front, necessitating driving the newly arrived animals through the streets of the city with the consequent danger of spreading infection. Even if properly located the grounds would still be unfit; they are surrounded by a bamboo and wire fence with no cross fences, so that only one shipment at a time can be accommodated. They contain two small sheds, one of which has no permanent roof. This lack of proper facilities has necessitated the quarantining of imported stock in private corrals scattered around the city. This method is always unsatisfactory and fraught with great danger.

Cebu.—Only a small number of animals from a foreign port arrived during the year. On account of the absence of a suitable quarantine station and of the expense of maintaining a veterinarian at this port, Cebu has been abandoned as a port of entry for foreign cattle.

MEAT INSPECTION.

During the fiscal year meat inspection has been conducted at Manila and Sisiman. The system has been remodeled and improved upon, and new report blanks have been provided which give a much clearer and more intelligible idea of the condition of the live stock presented for slaughter.

The system in operation in the Philippine Islands is based upon that used so successfully in the United States, with such slight modifications as were found necessary to meet local conditions. A number of veterinarians have been trained to this work so that the ante-mortem and post-mortem inspections conducted here are as efficient as that of any meat-inspection service anywhere.

The meat of all animals slaughtered here being eaten fresh and the markets not being under the supervision of the Bureau, the work of inspection is limited to the abattoirs. There being no manufacturing of meat food products, it has been necessary to destroy many carcasses, which otherwise might have been made available for food purposes.

Manila.—All classes of food-producing animals are killed at the Manila matadero—cattle, calves, sheep, goats, swine and an occasional deer. The Bureau has nothing to do with the sanitation of this plant, its activities being limited to the inspection of the animals offered for slaughter, but the construction of the building is so good, the water supply so abundant, and the supervision so efficient that little is left to be desired in the way of sanitation.

During the year a total of 76,336 animals were slaughtered of which 1,022 carcasses and 77,358 parts were condemned.

For further details see Table No. 13 (Appendix).

Sisiman.—The abattoir at Sisiman is owned and operated by the Bureau, the only slaughtering there being of cattle and a few sheep, all of which come from Australia.

During the year there were inspected 8,104 cattle and 36 sheep. Total condemnations were 167 carcasses and 5,893 parts.

For additional details see Table No. 14 (Appendix).

SIMULTANEOUS INOCULATION.

Upon the discovery of rinderpest among quarantined imported cattle in Manila and Iloilo, they were subjected to simultaneous inoculation. A dose of 50 cubic centimeters of serum, per 100 kilos estimated weight, was employed together with 1 cubic

centimeter of virulent blood. The results are shown in Table No. 17 (Appendix).

Lots 4 and 5 of cattle and 1 and 2 of carabao inoculated at Pandacan, were from infected herds transported to the quarantine station for the purpose. They, also, were from French Indo-China, but belonged to earlier importations that had been released. The results do not encourage belief that simultaneous inoculation of imported animals would be practicable.

DIVISION OF AGRONOMY.

The work of the division of agronomy during the past fiscal year has been confined largely to investigations concerning rice, forage crops and hay grasses.

RICE.

As rice is the crop upon which the great majority of the people of these Islands depend for sustaining life, it was thought that the greatest good to the greater number could be accomplished by trying to improve this crop first. Up to the opening of the last planting season nine hundred and ten varieties, native to these Islands, had been collected. Of this number four hundred and fifty-two were found to be lowland, or transplanted rice, the remainder upland. The lowland varieties were planted at Alabang, Rizal Province, on a stiff clay soil which had been used for rice culture for many years. The same varieties were planted also at San Miguel, Tarlac, on a rather new dark sandy soil. Irrigation water was available in both cases.

In testing these varieties much time was spent taking notes on each variety in order that comparison may be made with its behavior under different conditions and in subsequent years, and also in order to be able to identify varieties and eliminate duplicates. Observations were made under eighty-eight different headings for each variety covering the entire history of the plant from sowing to harvest and every part of the plant which may be found to vary. This information is necessary in making a close study of the varieties.

The upland varieties were planted on the same land as last year except that this land had been grown in velvet beans during the dry season which left it in good condition for the succeeding crop of rice. The yields, however, were not up to the year before mainly on account of the fact that the rains were not as frequent as the year before. One very peculiar fact was noticeable in regard to the crop; while the rainfall was less than the

year before, particularly near the harvest time, the varieties took three to twelve days longer to mature than they did the previous year.

A full report on the rice work done up to this time is now in the hands of the printer and will be published as Bulletin No. 22.

FORAGE PLANTS.

Rhodes grass.—Forage and hay grasses have been tested at several of the farms during the past year. Rhodes grass (*Chloris gayana*) seems to be the only one suitable for hay-making. One of the main objections to the larger grasses is the fact that they can not be cured easily. Unless hay is quickly and thoroughly cured in this climate it is not of much value. All of those grasses related to the sorghum are subject to rust which renders them practically worthless during the damp weather.

Rhodes grass was used for hay-making at Alabang, Rizal Province, and at San Miguel, Tarlac, on the hacienda "Luisita."

At Alabang about 1 hectare of Rhodes grass was grown with the idea of producing enough hay to make a feeding test. The ground was prepared in the usual way and the seed sown in drills. The sowing in drills was found necessary in order to facilitate irrigation. If the field had been located on level land so that it could have been flooded, it would not have been necessary to sow in drills. It requires from 3 to 15 kilos of seed to plant 1 hectare, depending upon the quality of the seed and the condition of the soil. In starting a field of this grass it should be sown in October in order to give the young plants a chance to get well established before the dry weather sets in. If hay growing is the prime object, the crop should be irrigated about every fifteen days during the dry season, depending upon the weather.

After the first cutting the grass will grow up large enough to cut again in two months, so that two and sometimes three cuttings may be obtained in one season. The average yield at Alabang was about 2,000 kilos of cured hay per hectare, for each cutting. As the last season was rather unusual it is thought best to secure further data before making any positive statements as to yields.

The hay made from this grass appears to be equal in every way to timothy. It was used exclusively for feeding the stallions for over six months.

At San Miguel, Tarlac, it was expected that at least 10 hectares could be planted in order to produce enough hay to make a

commercial test, but only about 2 hectares of the ground were prepared and planted. The time of planting was so delayed that only one cutting was obtained. The soil at San Miguel is rather rich and the grass grew too tall and heavy for making the best hay. Five tons of hay were obtained from the 2 hectares at the first cutting. If the seed had been sown at the proper time at least three cuttings could have been saved which would have resulted in a yield of not less than 7.5 tons of hay per hectare during the season. This hay should be worth not less than ₱60 per ton on the Manila market. No definite statement can be made as to the cost of producing this hay as the land was new and rather expensive to prepare and the harvesting was done by hand owing to the fact that there was not enough to make it worth while to send up a mower. As soon as sufficient area can be obtained, a test of the cost of harvesting will be made. One of the problems yet to be solved is how to take care of the Rhodes grass during the rainy season. Those who grow only a small quantity may be able to keep it down by using it for zacate during the rainy season.

Guinea Grass.—Guinea grass continues to be our best soiling crop. We now have large areas growing at Alabang and La Carlota for use as a green feed.

Japanese Cane.—The variety of Japanese cane tested last year has proved itself adapted to this climate and has been planted on a large area at Alabang with the object of using it in conjunction with sorghum as a soiling crop and for filling the silo.

Sorghum.—Three varieties of sorghum have been tested at Alabang and at La Carlota. Red Amber gave 24,000 kilos of green forage and 2,616 kilos of seed per hectare; this variety seems to grow more evenly than the other varieties. Minnesota Amber gave 24,000 kilos of green forage and 1,960 kilos of seed per hectare. Sumac Amber gave 21,600 kilos of green forage and 1,960 kilos of seed per hectare.

Cowpeas.—Cowpeas have been tested at Alabang and La Carlota. New Era gave fairly good results. The vines grew well and remained fairly free from insect pests and diseases. The yield of clean seed was 2,462 kilos per hectare. The varieties Iron, Groit, and Brabham did not make a satisfactory growth.

SILLO.

During the latter part of the fiscal year a circular concrete silo 5 by $8\frac{3}{10}$ meters was constructed at Alabang for storing forage crops. While green feed may be obtained at any season in

this climate it has been found that there are times when we have an abundance of feed for our cattle and at other times there is a shortage. It was to remedy this defect that the silo was constructed. The silo was filled with sorghum at a cost of ₱1.87 per ton for cutting and hauling. The average haul was 1 kilometer.

As opportunity offers, various crops will be used for filling the silo, such as cogon, sugar cane, corn, Guinea grass and some of the legumes.

SUGAR CANE.

Six Hawaiian varieties of sugar cane Nos. H-16, H-20, H-27, H-69, H-227 and H-309 have been tested at Alabang, Rizal Province, with the native cane. The following tabular statement shows the laboratory tests of the Hawaiian varieties and native variety as made by the Bureau of Science:

Number.	Juice, per cent.	Polar- ization, per cent.	Brix.	Purity coeffi- cient.
H-16	75.8	14.3	16.3	87.8
H-20	90.3	18.3	19.3	94.9
H-27	77.3	17.0	17.9	95.0
H-69	81.8	12.9	15.0	86.0
H-227	78.3	14.1	15.9	88.8
H-309	93.2	14.9	17.1	87.6
Native cane	78.8	19.9	20.7	96.5

At La Carlota, Occidental Negros, the following varieties of cane were grown in addition to the varieties mentioned above. Striped Louisiana, Rose Bamboo, Yellow Caledonia and Lahaina. All of the varieties were grown in $\frac{1}{10}$ -hectare plots with the idea of increasing the area as the demand for seed cane increases.

LA CARLOTA EXPERIMENT STATION.

Labor.—Contrary to usual conditions there has been an ample supply of laborers in this district since January, 1912. This was caused by the shortage in the last rice crop. Many of the people who usually confine their labor to the rice fields were forced to seek employment wherever they could find it. Ordinary laborers have been paid ₱0.60 per day throughout the year.

Climate.—As the fiscal years 1910 and 1911 were years of unusual rainfall, that of 1912 has been one of unusual drought. While the records of this station show the rainfall for but six years it seems to be the general opinion that it has been at least twelve years since an equally dry year has occurred in this district.

Improvements.—During the year 1,470 meters of woven-wire

fence and 5,145 meters of barbed-wire fence have been constructed at this station. This fencing, together with sundry repairs to buildings, constitutes the only permanent improvements made.

Insect Pests.—Although several flights of locusts have passed through this district none have visited the farm during the year. The fields which are frequented by the “buc-an,” not being in cane last year, show but little effect of the work of this pest, though occasional hills of cane throughout the whole planted area were destroyed both by the “buc-an” and by white ants. About June 1, 1912, myriads of small, green caterpillars appeared in different parts of this district. They attacked the rice seedbeds, young corn and young sugar cane, but up to the close of the year have done no damage at the station.

Crops.—Practically all of the grass and legume seeds brought to the Philippines by Prof. C. V. Piper during the previous year were thoroughly tried out at this station. On account of the very severe drought a large number of these crops failed. Those succeeding especially well were the sorghums and some of the cowpeas. Six varieties of soy beans did fairly well. The maize tests were unsatisfactory. Peanuts did fairly well and Indian Guars did well in the dry season but appeared unable to endure rains. A number of the European beans started well but failed to set much fruit. A native bean known as “balong” made a splendid growth and appears to be unsurpassed as a Philippine cover crop. The Kulthi of India has also given excellent results, though no seed has been obtained. These two crops appear to solve the question of cover crops, at least for the Visayas, since they not only make a heavy blanket but are apparently free from either fungus or insect attacks and are of rapid growth. Among the best of the grasses grown at this station were the Sudan, which made a strong vigorous growth, reaching $2\frac{1}{2}$ meters in ten weeks, and the Rhodes grass, which also grew quickly. A considerable variety of vegetable seeds have been tested.

Operations.—During the milling season approximately 40 hectares of cane, which produced 2,500 piculs of sugar, was harvested. Of this area of 40 hectares 5 hectares were of two-year-old cane, 7 hectares rattoons and 28 hectares plant cane. The yield was $62\frac{1}{2}$ piculs per hectare. There have been planted for experimental purposes and for seed distribution thirteen varieties of sugar cane. These plats, together with the number of fertilized plats of sugar cane, occupied 2.6 hectares of land.

Twenty-one varieties of abacá covered two-thirds of a hectare

and the balance of the experimental plats occupied 3.56 hectares. The greater part of the abacá has been stripped. This work was done on shares, the strippers receiving one-half and in some cases three-fifths of what they cleaned. Three small bales of abacá were shipped to Manila after keeping what fiber was needed for making ropes at the station. The total amount of land under cultivation at this station on June 30, 1912, was 20.56 hectares.

DIVISION OF HORTICULTURE.

The operations of this division include, in addition to the purely horticultural work, seed and plant introduction and distribution, entomological work, and the supervision of the Singalong experiment station, the Lamao experiment station, the Trinidad garden and the Ilagan tobacco station. Arrangements have been made to lease the larger part of the Trinidad garden and the remainder of this station will be placed under the supervision of the demonstration and extension division.

HORTICULTURE.

There being no purely horticultural station it was decided to concentrate most of the permanent crop and plantation work at the Lamao experiment station, giving temporary tests and propagation work to the Singalong experiment station.

The work at Singalong has been under more or less confusion, although a small force of labor was maintained on purely horticultural work throughout the year.

On account of the prolonged drought and the necessity for using a limited amount of water in attending to the nursery stock there, a considerable amount of mineral salts were gradually brought to the surface where, in the case of citrus seedlings, the poisoning effect was so severe that a large percentage of these plants succumbed and it became necessary during the latter half of the year to remove the more valuable varieties for permanent planting to the Lamao experiment station. To obviate the danger from soil salts accumulated at the surface, a large, light, half-shade bamboo shed was erected over a portion of the grounds and about one-third of the area therein was carefully worked over and built up so that there should be ample drainage at the bottom of the two 30-meter-long beds; sand and humus were mixed with the surface soil for these beds, which was brought from adjoining property, and recent tests of this scheme indicate that hereafter there will be no difficulty in growing up to, say, 100,000 seedling trees throughout the year at Singalong.

Early in the year a small bamboo and nipa shade shed was

constructed at the nursery grounds at Singalong and this has been constantly in use for the propagation of anonas, palms, cacao, Artocarpus, etc.

A collection of economic aroids has been started and is gradually being extended as new varieties are added. A large collection of yams, mostly obtained at the Philippine Exposition in February, are now in full growth; this is practically a duplicate of the Lamao yam collection.

Several tests of maize have been made and a plat of the Helianti variety of Jerusalem artichoke has been tested and propagated for distribution; there appears to be no question as to the suitability of this plant for a green roughage ration. Tests of vegetable seeds from the seed room were made at intervals to determine the viability of seeds.

Since the horticultural work at the Lamao experiment station has been so closely allied with the general station work, a report thereof will be made under the said station.

A small citrus nursery has been started at the La Carlota experiment station.

The chief of this division, accompanied by the assistant horticulturist, made an investigational trip around the Island of Mindoro in June but very little economic material of importance was collected. The horticulturist and assistant horticulturist have made a number of short trips in the provinces of Batangas, Nueva Ecija, and Rizal. One other employee of the division has spent several months on collecting trips in the Provinces of Batangas, Bataan, Tarlac, Pampanga and the Island of Cuyo. A number of new and promising varieties of native fruits and vegetables were collected by him.

SEED AND PLANT INTRODUCTIONS.

The principal new plant material introduced into the Philippines during the year was 2,000 plants of Cayenne pineapple, and 1,000 plants Red Spanish pineapple. About 27 varieties of native citrus trees have been collected; and about 50 varieties of oranges, pomelos, limes, and lemons, from foreign countries have been successfully introduced.

Twenty-six varieties of India mangos were received as inarched plants. Two hundred avocado fruits came in cold storage from Honolulu in November and seeds from these three "new types" are now growing at Lamao and budwood from several varieties of avocados has also been received from California and Hawaii and for the first time in the history of the Philippines has been successfully budded on seedlings at the Lamao station.

Several varieties of *Anonas* have been introduced and the famous Brazilian Biriba has been received from the collection of Mr. William Lyon, at Nagtajan Gardens, Manila.

About six new varieties of Roselle have been introduced.

Some six new varieties of bananas have been added to the collection.

SEED AND PLANT DISTRIBUTION.

There has been a phenomenal increase in this line of work over that of 1911. This has been brought about largely by the change of policy regarding the furnishing of *small* collections to *all* applicants instead of the previous system of large collections to a limited number of applicants of a special class.

Whereas in 1911 only some 5,000 allotments of vegetable seeds were recorded, it is estimated that about ten times that number have been handled during the past year. During the busy portion of the season, say from August to March, some sixty to one hundred requests by mail were received per day. In addition to the requests by mail, a considerable number of personal applications were made at the seed room, these amounting some days to twenty-five or more "student requests." Reckoning the average number of varieties per allotment at eight, and the probable number of requests exclusive of wholesale distributions to teachers and extension work coöperators, it is estimated that nearly half a million individual packages of seeds were distributed.

Eight collections containing from six to twenty varieties of seeds each were put up in the seed room, the idea being to give only a limited number of varieties to the average student, while the hacendero should receive not only a generous quantity of cover crop and forage seeds, but practically all of the varieties of vegetable seeds as well. It is believed that the system has proved of much greater economy than the previous one; it is estimated that several hundred pesos in postage have been saved by this change—only four or six centavos being required on collection "V-6" instead of the ₱0.32 required for the old lots.

The increase in number of flower-seed collections distributed has not been so great as was expected. It is estimated that against the five hundred and sixty-one collections of flower seeds and fifty packages of ornamentals and miscellaneous seeds sent out in 1911, only from four to five times this number have been handled in 1912. These collections have not been featured and it is considered advisable to discourage this line of seed work during 1913, thus leaving the ornamental varieties to be obtained

from *private dealers*, except in the case of school gardens and special coöperators.

No open objections or complaints were received from any dealers in seeds by reason of the free-distribution system of this Bureau; the objections made in the past to this feature of the Bureau's work appear to have been gradually removed, presumably by the increased demand for seeds from private dealers through the popularization effect of the Bureau's far-reaching distributions. Against some 20,000 mulberry cuttings distributed in 1911, about 60,000 to 75,000 have been handled in 1912. To schools of the Bureau of Education and the Silliman Institute at Dumaguete no charge has been made for this material, but to private parties a nominal charge covering cost of labor in cutting, packing, and shipping to Manila from Lamao experiment station has been made; this distribution to private parties brings in from ten to fifteen pesos per month.

During the year a special feature was made of the Roselle and over 3,000 packages of seeds were distributed during the latter half of the year, one at least being sent to each municipality in the Archipelago. At least 2,000 packages of selected papaya seed have also been distributed.

About 3,000 Carabao and Pico mango seeds have been distributed to the principal botanic and experimental stations with which the Bureau has been in correspondence during the year.

A considerable quantity of such seeds as Roselle, papaya, okra, native squashes, etc., have been grown at Lamao experiment station for distribution from the Manila office; no credit has been made to the said station for this material. Trinidad garden also has furnished a quantity of radish, lettuce, pea, and bean seed.

A fumigating chest has been installed and this together with the zinc-lined boxes and tin storage cans make the seed-room plant practically above criticism.

ENTOMOLOGICAL WORK.

Locust Work.—Act No. 2121 of the Second Philippine Legislature, which provides means for the extermination of locusts, was enacted on February 1, 1912. Steps were at once taken by means of correspondence and circular letters to obtain information regarding locust conditions in the provinces and also to arrange for the appointment of the Provincial Locust Boards. The necessary office and field equipment for carrying on this work was obtained.

The locust outbreak in Cebu is probably the worst single attack of this pest to be reported for several years. It seems to have arrived at the southern point of the Island from the Island of Bohol about the middle of May, 1912. The municipality of Oslob, some 22 kilometers from Bohol, was the first point attacked. This swarm was reported to have covered about 15 square kilometers and remained there a short time. On May 24 the swarm began to move northward toward Dalaguete and Argao. On May 30 it had crossed the Island from east to west appearing at Barili where it broke up into several small swarms, some continuing toward the north and the remainder recrossing the island to the east coast. By the middle of June a considerable number of new localities were attacked, practically the entire southern half of the island being more or less affected. These flying adults deposited eggs prolifically in every locality in which they alighted and the danger from the newly hatched swarms will continue to be very severe for several months to come.

Considerable damage to maize was erroneously reported at Barili; the principal damage done at the first attack was to coconuts and bamboo. By July 17 some of the eggs began to hatch and by the 19th measures were being taken for the prompt extermination of the pest. In the worst afflicted district, the municipality of Asturias, no steps toward combating this pest were taken and the Bureau entomologist experienced great difficulty in interesting several of the municipalities in active operations.

On account of a famine in the afflicted districts of Cebu, the people were practically unable to work more than half a day at a time, the remainder of the day being spent in obtaining their food which consisted of "buri" and fish. On June 24 the entomologist held a conference with the provincial governor regarding measures for obtaining the requisite labor for controlling the swarms. It was found that there was ₱202 in the provincial treasury remaining from the locust and calamity fund and of this, ₱150 was used for the immediate purchase of rice, leaving the balance of same for its transportation to the west coast where it was used as rations for the locust gangs. At Toledo and Asturias, 1 ganta¹ of rice was allotted for every ten persons per day; at Balambang 1 ganta of rice was exchanged for 1 cavan of locusts.

No difficulty was found in securing enough labor so long as

¹ 1 ganta equals 3 liters; 25 gantas or 1 cavan equal 75 liters.

there was rice for feeding the men but upon the supply's being exhausted all eradication work, especially at Asturias, practically ceased.

At Balambang and Toledo as much as 50 cavans of "loctones" were destroyed per day while at Asturias it averaged less than 10 cavans.

On account of the urgent need for the entomologist to oversee the practical field operations in person in order to prevent waste of time and effort, he had very little time to study the life history, parasites, etc., of the locusts.

At the close of the fiscal year matters were in a very bad state in most of the districts of the island with the exception of the extreme northern part. The presence of the entomologist at the scene of action was of inestimable benefit and has probably resulted in the saving of tens of thousands of pesos worth of crops.

Up to July 1 locust outbreaks were reported to the office from 74 municipalities in 15 provinces. With a few exceptions all of these outbreaks were promptly controlled by the municipal or provincial authorities, close touch by letter and telegram being maintained with the locust office.

Miscellaneous Plant Pests and Diseases.—The unusual season during the past fiscal year has been largely responsible for the seriousness of some insect pests and the comparative absence of others.

For instance, the floods which followed the rains of July and August caused a considerable diminution in the number of rats in the cane fields of the Pampanga and other river valleys. However, those areas of cane which were not inundated in localities adjacent to the flooded areas were practically destroyed by the concentration of rats therein. Some 30 packages of arsenic were distributed for use in poisoning rats in those areas and special directions for the use of this poison were drawn up by Mr. Mackie and the chief of this division; this apparently had excellent results.

The prolonged drought caused a great scarcity of food for many Phytophagous pests and those which were unable to "hibernate" were probably greatly reduced in numbers. In some cases, the locusts which ordinarily kept to the higher altitudes were forced to descend from the mountains and settled upon the cultivated districts along the rivers causing immense losses to the planters.

The drought moreover caused some variation in the habits of

the army worms; toward the close of the year these caterpillars caused very serious losses in maize, rice, and young cane plantations, especially in Cebu and Negros; this outbreak is the worst since that which occurred in Batangas in May and June, 1910.

During the year a total of 400 communications have been received relative to plant pests and diseases; these may be classified among the principal crops as follows: locusts, 265; rats, 18; coconuts, 24; rice, 10; tobacco, 7; and miscellaneous, 62.

A comparatively unimportant but new species of coconut scale (*Aleyrodicus destructor* Quaint.) was discovered in Negros by Mr. Mackie; an account of this pest was published in the REVIEW for March, 1912.

Two apparently new coconut pests, *Chalcosoma atlas* and *Xylotrupes lorquini*, have appeared. A detailed account of the coconut pests appeared in the "Coconut Number" of the REVIEW (May, 1912).

Two comparatively new cane pests have also been in evidence, one, a small aphid, attacking the roots, and the other, a small Cicada, which during the prolonged larval stage feeds in colonies upon the cane roots and stem bases. In this connection may be mentioned a rather rare plant parasite, *Aeginetia indica* Roxb., of the Orobanchaceae; this plant attacks the roots of the cane in Negros causing weakening of the stools.

A banana-root weevil, *Cosmopolitus sordidus*, first noted by the chief of this division at Singalong, has been studied; this appears to be a potentially dangerous pest. Several interesting citrus pests have been studied during the year; a new species of *Aleyrodes* has been discovered and a probably new Psyllid which feeds in colonies upon the newly opened leaves and young shoots.

The only new mango pest worthy of notice during the year was a large boring beetle of the Cerambycidae (Subf. Lamiinae); this appears to be the same borer which has been so severe at the Lamao experiment station in avocado trunks. The other mango pests mentioned in the report for 1911 have remained in *statu quo*. Three apparently new rice pests have been studied and in the forthcoming rice bulletin are described in detail by Mr. Mackie; they are *Schoenobius punctellus* (a small moth); *Melanites ismene* (a butterfly); and *Leptocorisa acuta* (a bug).

Maize pests seem to have been confined to the Noctuid army worms.

The work begun near the end of the previous fiscal year on the cigarette beetle, *Lasioderma serricorne*, was completed early in this year; an article on this pest appeared in the November, 1911,



PLATE IV.—CLEANING RICE, LAMAO, BATAAN.



PLATE V.—COCONUT GROVE, SHOWING BAMBOO POLES IN TREES FOR
GATHERING TUBA, NEAR MAJAYJAY, LAGUNA.

(Photo by C. M. Conner.)

number of the REVIEW, and Circular No. 5 was published on the *Cigarette Beetle* (English and Spanish). Important experiments were carried on in two of the largest tobacco factories in Manila for the purpose of determining precise methods of controlling this pest which previously was causing several hundred thousand pesos loss annually to tobacco dealers and manufacturers.

BEES.

One swarm of Italian bees was successfully introduced from Hawaii in February, 1912. Honey producing plants have also been established at the Singalong experiment station where this swarm is now located.

TRINIDAD GARDEN.

The object of the work carried on at this garden has been twofold: the testing of temperate and tropical vegetables and forage seeds and the experimental marketing of the ordinary varieties which can be economically produced in wholesale quantities. The forage tests begun by Prof. C. V. Piper at Trinidad garden have given such poor results in general that only a small part of the original number have been carried through the year.

Climatic Conditions.—There were three severe typhoons during the year. The first two did considerable damage by washing out or covering up the strawberry plants and by washing away large portions of the river bank and a portion of the fence.

Insect pests and Plant Diseases.—Not only were plant lice and cutworms very much in evidence during the vegetable growing season, but nematodes did considerable damage and the cabbage worm severely affected the cruciferous crops. Insecticides were used with good success.

The principal fungus diseases were anthracnose on beans and cucumbers, a blight (apparently a *Fusarium*) on tomatoes, and a downy mildew on peas. With the exception of the tomato blight these diseases were controlled by applications of Bordeaux mixture.

Crops.—About sixty varieties of vegetables were tested of which only the following proved fairly successful; beans, beets, cabbage, kohlrabi, lettuce, peas, radish, sweet potatoes, and turnips.

A large number of grass and forage legumes were tested but with a few exceptions no good stand was obtained with any of the varieties.

The only fruits aside from strawberries of any particular

importance were the mulberries of which some ₱300 worth were sold. About ₱770 worth of strawberries were produced; this amount would have been increased by probably ₱300 except for the damage done in July and September by the typhoons.

The principal items of vegetable sales were peas, about ₱760; cabbage, ₱805; lettuce, ₱171; raddishes, ₱121. Roses and other flowers to the value of ₱388 were sold. Charges of about ₱140 were made for baskets and special deliveries.

LAMAO EXPERIMENT STATION.

The plat work and field divisions of this station were reorganized during the latter part of the year. A preliminary survey of the station was begun in the latter part of June by the horticulturist and the superintendent. New roads and avenues were staked out and field limits were established.

Crops.—Papaya breeding has been entered upon on a large scale by the horticulturist.

A collection of about thirty-three kinds of yams are now under test.

A comparative test of the Roselle varieties is now in progress.

One of the most important discoveries made during the year was the possibility of vegetative propagation of cacao by bud-dage; the horticulturist deserves great credit for this achievement.

The legume collection now carries some sixty-five varieties, each with an area of from 100 to 400 square meters.

The pineapple plats take up considerable valuable area but considering the recent interest taken in this crop it is believed the division should be ready to distribute or to sell at cost a large number of the best varieties for Philippine conditions in the fiscal year 1914.

Both the Liberian and Robusta coffee plats have done as well as could be expected during the year considering the ubiquitous blight which has, of course, greatly reduced their vitality.

The abacá in field "B" set out in July has done fairly well considering the prolonged drought.

The corn-breeding plats have not been successful and Mr. Burrell's experiments in this line have been discontinued; a new series of tests have been begun.

A considerable area has been devoted to nurseries and small permanent plats of the principal tropical fruits such as anonas, avocados, guavas, chicos, mangos, tamarinds, etc.

The top-working of old mango trees has been begun at Lamao, the method being the same as that used in the previous year in the large mango grove at Muntinlupa, Rizal.

Especial attention has been given throughout the year to citrus work and the nursery crops now in evidence are undoubtedly the best and largest of the kind in the Orient.

SINGALONG EXPERIMENT STATION.

As in the past, but to a greater extent than in any previous year, the unsettled status of this station has prevented any experimental work. During the first part of the fiscal year over one-third of the station was transferred to the City of Manila and it appeared that the remainder would be sold at an early date. About January 1, 1912, arrangements were made to retain this station in the Bureau of Agriculture. As a central point for handling live stock, plants and other property of the Bureau received in Manila for transshipping to other points, this station is particularly useful. It can also be used to advantage in certain lines of horticultural work.

Labor conditions have been fairly satisfactory at this station throughout the year and no difficulty has been experienced in securing necessary labor at all times.

Weather conditions have been very unfavorable. Crops suffered from too much water during the first three months of the fiscal year and from too little during the remaining nine months.

Crops.—Guinea grass has been the principal crop grown at Singalong. Other forage crops grown have been Sudan grass, Rhodes grass, Tunis grass, *Paspalum dilatatum*, *Panicum hirsutissimum*, Molasses grass, Pará grass, Teff, and beggarweed. Sixteen varieties of beans were planted at this station in March, 1911, under the direction of Prof. C. V. Piper. Two of these varieties failed to germinate and one was destroyed by the storm of July. Seed has been obtained from the other thirteen varieties.

ILAGAN TOBACCO STATION.

Permanent Improvements.—The superintendent's house which was begun during the previous year was finished during the early part of 1912. One foreman's house, a combined stable and storeroom, and several small temporary buildings have been constructed.

Crops.—The very exceptional drought experienced throughout the Cagayan Valley from November to June has practically prohibited success with tobacco experiments. Only by careful man-

agement were any results obtained that could be called favorable either with tobacco or maize. A fair amount of cowpeas was raised and some $2\frac{1}{2}$ cavans of Lyon beans were harvested. Tests were also made with various sorghums and grasses.

The first set of tobacco seedbeds gave a good showing but before the ground was in condition for planting the seed plants were too large and had to be discarded. The second set of beds was attacked very badly with "chin rot" and about 90 per cent of the plants were destroyed. The third set of beds was prepared on November 21 and sprouting seeds of the best Cuban and native varieties were sown; but again the blight struck the beds killing in spite of all precautions about 40 per cent of American tobacco plants and some 90 per cent of the native varieties. On January 2 a fourth attempt was made using six types of native seed but because of the extreme drought and the lateness of the season they were largely discarded although in a fairly healthy condition. Several attacks by both the true and the false budworms were experienced; the caterpillars were held in check by Paris Green during the early part of their existence and later when the plants were too large for this treatment hand-picking was resorted to.

A small field was rented, semiofficially, for testing some of the plants on rich alluvial soil near the river.

On account of the very hot dry weather, none of the tobacco developed properly and premature ripening made it necessary to begin the harvest before the plants and leaves were properly developed; on the average each plant carried only from nine to eleven good leaves instead of the usual eighteen to twenty. The premature ripening caused the leaves to have a heavy texture and bad color. Three pickings, however, were made, the first sixty-one days from time of transplanting, the second sixty-five days, and the last seventy-four days.

There being no curing shed at the station, it was necessary to rent a small space (one-half of a local warehouse) where the demonstration of the correct methods of folding, stringing on sticks, and air-curing could be carried out. At the close of the year the tobacco thus cured by modern methods is being fermented, hence no detailed report can be made as to the precise quality and quantity in evidence.

Coöperative Work.—This feature of the Ilagan station work has been of more practical value in the Cagayan Valley than all the other features combined; it is, however, an entirely new departure from previous tobacco work done at the station and

has met with some slight opposition by the very conservative native planters in the valley.

In the matter of cleaning the seed for the better class of planters, much good was accomplished, during July, August, and September, Mr. Rowe, accompanied by internal revenue agents Stegner and Manus, visited every tobacco-producing municipality on the Cagayan River in both Isabela and Cagayan Provinces for the purpose of demonstrating the use and benefit of the tobacco seed-cleaning machines. During the trip seed was cleaned gratis for 1,712 tobacco planters; the quantities varied from one-half to 10 gantas for each planter. This work has resulted in a great demand for seed separators; the provincial treasurer himself ordered 12—one for each tobacco municipality of Isabela. Very favorable results have been reported to Mr. Rowe by those planters who “broke custom” and had their seed winnowed of the dirt, trash, and mildewy material usually in evidence in Cagayan seed; and many planters who did not allow their seed to be cleaned have since come forward with the request that during July and August of 1913 their seed, also, should be attended to.

The district health officer has appointed the two traveling inspectors as special sanitary agents for the enforcement of the ordinance prohibiting the storing of tobacco underneath the houses of the planters.

The good effects of Mr. Rowe's and the inspectors' teachings regarding curing, etc., are now in evidence; there are now some six hundred and thirteen curing sheds in the municipality of Ilagan alone, where practically none existed one year ago.

A strong feature of the instructions and advice given to the native planters by Mr. Rowe and his inspectors has been the “multiple-crop” system, i. e., the planting of maize, beans, rice, rootcrops, and vegetables instead of the one-crop system practiced heretofore.

FIBER DIVISION.

OUTLINE OF WORK.

The following lines of study and investigation have constituted the chief activities of the fiber division during the fiscal year 1912:

1. A study of the fiber and other industries of Java through which country the fiber expert made a hurried trip after attending the Surabaya Fiber Congress and Exposition as a representative of the Philippine Government and in charge of the Philippine fiber exhibit.

2. Abacá investigations covering practically all the phases of

the industry, particularly those that had not been fully investigated before and those that have only recently been developed.

3. Maguey and sisal investigations bearing on the improvement of the present condition of the industry, and a preliminary investigation as to the prevalent diseases and insect pests of the plants.

4. A study of the various phases of the kapok industry in Java and the Philippines, and an attempt to facilitate and encourage its development here.

5. A preliminary study of some of the species and types of cotton grown in the Philippines, which is intended to form the basis upon which the more detailed investigation and experimental work of the coming year will be conducted.

6. Investigations relative to some of the household fiber industries of the Philippines and also to the fiber plants of minor or local importance.

7. The dissemination of information pertaining to Philippine fiber by means of articles and notes published in the PHILIPPINE AGRICULTURAL REVIEW and by correspondence.

ABACÁ INVESTIGATIONS.

Abacá Varieties.—This study, which was begun in 1909, was continued this year. The two districts where it was made were southeastern Mindanao and northeastern Leyte, where more varieties are found, and also where the plants, generally speaking, reach a larger extent of growth than anywhere else. The results of the study in southeastern Mindanao have, on the whole, confirmed the results of previous studies; but in Leyte the tentative description of the varieties made two years ago was found in many cases to be incomplete.

One of the important features of the study of abacá varieties in the districts mentioned above was the discovery that the varieties grown in both localities were, with perhaps few exceptions, identical. The Tangongon, Bangulanon, Arupan, Pulajan, Punucan (Libuton), Sinabá, and Baguisanon varieties of southeastern Mindanao are the same as the Ynosa, Laguis, Lagurhuan, Linawáan, Libutanay, Liahon, and Inalas varieties of Leyte, respectively.

Rootstocks of all the above varieties, with others in which the similarity was not so clear, were secured and planted in experimental plots at the La Carlota experiment station where it is also proposed to plant in the same manner and for the same

purpose, during the next fiscal year, the principal varieties from Albay and Negros.

From southeastern Mindanao seeds were also secured from the same varieties as the rootstocks. Propagation from seed is intended to show whether the varieties thus reproduced will show the same characteristics as when reproduced from rootstocks; and also to show the difference, if any, in the extent of growth of the plants, the length of their life, and the quality and quantity of their fiber. Seeds from the Leyte varieties could not be secured at the same time as the rootstocks and an effort to do so will be made later.

Cover Crops.—The general practice of planting camote, *Ipomœa batatas*, as a cover crop in fields of young abacá has been followed by abacá planters for two purposes: First, to reduce the expenses of cleaning the field by preventing the growth of weeds; and second, to preserve the moisture in the soil and prevent too rapid evaporation during dry spells. The planting of camote for the first purpose was discouraged by the fiber expert in some of the publications issued by the Bureau, and clean weeding and proper cultivation, where it is possible to practice them, were suggested instead. The experiences of various progressive planters have conclusively proven the advantage of our method over the old one. A series of practical tests made at the plantation of the Culaman Company, Malita, Davao, the results of which were witnessed by the fiber expert during his last visit in December, 1911, demonstrated that under normal weather conditions the fields that were periodically kept clean from all weeds grew about twice as fast as those in which camote was planted. At the age of six months the plants in the first plot were far more healthy and about twice as large as those in the second plot. At about the time camote was planted in the latter, a row of corn was planted midway between each two rows of the former, and thus the actual expense of keeping this free from weeds was almost offset by the crop of corn raised on it. In both places, however, regular plowing and cultivation were impossible on account of the large number of stumps and unburned trunks of trees.

Cultivation.—As in the case of cover crops, so in the case of cultivation, the methods suggested by this Bureau are gradually being used by the progressive and more intelligent class of planters. Occasional plowing, cultivation, and periodical hoeing have in all cases proved more advantageous and less expensive than the ordinary method of weeding by means of bolos.

The former method has also been found to require less labor than the latter, and thus a larger number of laborers were spared for the stripping and other operations that are necessary for the proper management of the plantation.

In this case also regular plowing and the systematic use of cultivators were found to be the most efficient means to save the plants from the effects of long periods of dry weather and unusual droughts that have been a menace to many abacá plantations during the year. On some plantations where irrigation ditches were run from a neighboring stream to offset the effects of droughts, the streams were either dried up or the quantity of water reduced to such an extent as to become lost in the ground before reaching the plantation.

The experiments in abacá begun during the year will not be restricted to study of varieties and their relative merits, but will also be extended so as to include other experiments relative to the use of shade trees, the raising of catch crops, modern methods of cultivation, etc. These will be conducted on a scientific basis, and complete records will be kept.

Production and Quality of the Fiber.—It is impossible at this time to give the exact figures relative to the production and exports of abacá for the fiscal year 1912, but it is believed that the exports are a little less in quantity and a little more in value than the preceding year. The fiscal year 1910 will therefore remain the banner year, with a total export of about 170,000 tons, or about 5,000 and 8,000 to 10,000 tons more than the years 1911 and 1912 respectively.

During the fiscal year 1912, the prices were slightly higher than during the previous year.

The quality of the fiber remains far inferior to what it should be, for reasons that have been explained in previous reports. In certain localities where there is a progressive class of planters the quality of the fiber produced averages over "good current," and the product is sold on the Manila market at prices ranging between 27 and 30 centavos per kilo (17 to 19 pesos per picul); while in the provinces where the bulk of the fiber is produced, and where the planters are, more or less, under the mercy of local buyers, the quality of the fiber hardly averages over "fair current," and their product is sold on the Manila market at an average of 17 to 21 centavos per kilo (11 to 13 pesos per picul). The difference between the above figures is more than sufficient to justify any efforts that it is possible to put forth to improve the quality of the fiber in the chief abacá provinces. The only means that this division can at present employ to

accomplish this end is printed matter and educational campaigns. Both of these means, it seems, have wrought no noticeable effect. During the year, the fiber expert was able to visit only one province, Leyte, where the principal planters from all the abacá towns on the east coast were invited to attend a conference for the purpose of discussing the industry in all its phases particularly the means that should be taken to improve the quality of the fiber in that province. Of the two hundred, or more, men invited only sixteen attended. The failure of many men to attend was not due to lack of interest but to the inopportune time assigned for the conference it being election time. The planters that attended were unanimous in approving methods recommended by this Bureau for the improvement of the conditions of the plantations and the quality of the fiber, but they stated that if they produced the superior grades, the local buyers would not pay them anywhere near what the quality of the product requires, and they themselves are not in a position to demand and receive just treatment. Coöperation among the progressive element of the planters and the introduction of practicable machines are obviously the two important things needed to remedy the existing condition.

Abacá Machines.—This is a problem that has not yet been satisfactorily solved. The many attempts that have been made within the last six years to invent suitable machines have, with one exception, proved a failure.

The only machine that has been reported to this office as giving encouraging results is the Crumb machine. This is simple both in construction and operation and can be used to advantage on small as well as large plantations.

Abacá Waste.—The production of abacá waste for use with old Manila rope in the manufacture of Manila paper has been practically discontinued; at least the encouragement for its production has been withdrawn in favor of the use of the entire abacá stalks crushed in a manner similar to that used in sugar cane.

"Knotted" Abacá.—By knotted abacá is meant the tying together of several fibers of the finest grade and reeling them in the form of a hank. Generally the few sheaths surrounding the core of the abacá stem are selected for preparing the grades necessary for this purpose.

It is only recently that the preparation of knotted abacá for export has been started. Owing to the length and great strength of the abacá fiber, this industry promises rapid development.

Pests and Diseases.—Fortunately the abacá plant still enjoys

freedom from any serious insect pest or disease. A small dark-colored weevil that attacks the tender leaves of the young plants before they are entirely opened was found in a field at Malita, Davao, and also at the La Carlota experiment station. This weevil has not yet been identified. It belongs to the Circulionidae family. It appears that this weevil attacks the tender leaves of abacá only during the dry weather. It was totally absent as soon as the rains set in. The damage done is very slight.

The banana-leaf roller, *Erionota thrax*, is another pest that occasionally attacks the leaves of the abacá at practically all its stages, but in this case also the injury to the plant is very slight, on account of the extremely scattered presence of the pest. This is supposed to be held in check by natural parasites such as *Chalcis thracis* Craw (n. sp.), egg parasites, and others.

The black banana weevil (*Cosmopolitus sordidus*) is another pest which is known to attack the banana and the abacá stalks. This bores through the stalk and usually kills the plant; but fortunately it is found only in a few localities, and even there, in very small numbers. The only remedy that can be recommended is to cut down the stalk and burn it completely.

The bacterial disease that has appeared on the plants at the Lamao experiment station is very serious, and it would be the greatest calamity that can ever happen to any agricultural industry in the Islands, if this disease should ever find its way to the abacá plantations. It is understood that the infested plants at Lamao have all been destroyed, and, if so, it will be necessary to keep under observation all the wild and cultivated species of *Musa* grown in the towns and barrios surrounding the station. This disease is not yet identified, but it is now in the hands of the Mycologist of the Bureau of Science.

A root disease, supposed to be fungus, has been reported from Albay. It is known by the Filipinos as "amasog," but the extent of its distribution, as well as its characteristics and the extent of injury caused by it, are not fully known.

The Status of the Abacá Industry.—Simultaneous with the gradual fall in the price of abacá which began in 1908, came a gradual decline in the condition of the industry in general. The abnormally high price paid for the fiber between 1903 and 1907 had wrought such an enthusiasm among the planters all over the Islands that abacá was planted in any locality, under any condition, and in any manner. While the price remained high, the planters realized large profits; but when the crash came, many plantations were found to be either so badly neg-

lected, or located on such poor soils, that this made it impossible to procure any profits without the exercise of judicious methods of cultivation in some and a complete renewal of others. These, however, were not practiced and the natural consequence followed. Very few plantations could more than make both ends meet, and it was only a short time before the majority of the producers were at the mercy of the local buyers. And, as if to make things worse, the quality of the fiber began to decline, for reasons fully explained in the previous reports of this office.

This Bureau recommends the simplification of the present standard grades of abacá, the encouragement of the invention of abacá machines adapted to the present conditions of the plantations, and the prohibition of the sale of those inferior grades which are the result of extremely careless methods and in the preparation of which the producers can not possibly realize any profits. The principal cause for the production of such inferior grades is claimed by the majority of producers to be the unjust dealings of the local buyers who, for obvious reasons, do not sufficiently discriminate between the inferior and superior grades of the fiber. An investigation into this may also lead to the removal of one of the most serious impediments to the development of the industry.

MAGUEY AND SISAL INVESTIGATIONS.

Change in Nomenclature.—Until a few years ago, the three principal species of Agaves, namely: maguey, sisal, and henequén, have been technically named *Agave americana*, *A. rigida sisalana*, and *A. rigida elongata*, respectively. These have recently been found to be incorrect, and the following technical names, in the order given above, have been substituted: *A. cantula* Rex., *A. sisalana* Per., and *A. fourcroydes* Lem.

Possibilities of Maguey.—The cultivation of maguey in the Philippines can be greatly extended. Large tracts of land, and in some cases whole provinces and islands, are better suited for raising maguey and sisal than raising any other tropical plant of economic importance, with the possible exception of some fruit trees. Such locations, on account of their rather poor soil conditions, the prevalence of long periods of droughts, or the scarcity of work animals, are not, generally speaking, suitable for the cultivation of any of the principal Philippine crops. Examples of such locations are found in the following provinces and islands: Ilocos Norte, Ilocos Sur, La Union, Cebu, Siquijor, Mactan, Guimaras, and considerable tracts of land in a few other islands.

Production of Maguey.—The production of maguey is only a very small fraction of what it would have been if the industry were conducted in a more modern and systematic manner. Millions of plants are left untouched every year simply for the reason that they are not sufficiently concentrated to permit of the use of machinery. Of the fiber produced considerable quantities are used by the Filipinos for local purposes such as cordage, cloth, harnesses, and others. The exportation of the fiber has been gradually increasing in quantity, but by no means at a rate to correspond with its importance and prospects.

Enemies and Diseases.—Here in the Philippines there are as yet no serious enemies or diseases that threaten maguey. The few that have recently appeared are not of a nature that would cause any uneasiness, and it is believed that they can be kept in check and restricted to the localities where they are found.

Goats and cattle practically constitute the only animals that are liable to injure the plants, if they are allowed entrance to the fields. These usually go after the young and tender leaves, especially where these are left exposed, as a consequence of over cutting.

The scale insect, *Aspidiotus orientalis*, Nuv.¹ which is common in the eastern tropics has been discovered on a few plants at the Lamao experiment station. The extent of injury done by these scales is so slight that it is feared that any spraying or other method that can be adopted to eradicate them may injure the leaves more than the scales themselves. It is, however, planned in the near future to destroy all plants that show any signs of this disease.

A fungus disease, supposed to have been introduced from Hawaii, was discovered by the fiber expert on some plants at Lamao. Specimens were secured and submitted to the Mycologist of the Bureau of Science and to the Bureau of Entomology, United States Department of Agriculture. From both these sources it was impossible to identify this fungus with certainty, owing to the fact that the fruiting spore cases in the specimens were immature. More specimens will be secured for further study.

A mealy-bug (*Pseudococcus*) was also discovered on tender leaves of suckers at Singalong. The leaves of the full-grown plants were entirely free from it. This becomes prevalent only during the dry season, and is common on other plants and trees.

¹ Identified by the Bureau of Entomology, United States Department of Agriculture.

The Present Status of the Industry.—The gradual fall in the price of most cordage fibers since 1908 wrought the same effect on the maguey industry that it did on the abacá. The difference between the two, however, was that at the time the maguey industry had not yet been fully developed, the boom having practically started during 1904, or perhaps a little earlier. The inevitable result of disheartening the new planters led to the abandonment of many plantings, which had been recently started and which had not yet reached the producing stage, and also to the giving up of projected plantings.

Conclusion.—The problem of putting the maguey industry on a more modern and more promising basis is very much less complicated than that of the abacá industry. The first step that must be taken in this case is to show the growers of maguey that a reasonable profit can be made from their plantings, and this can only be accomplished by the use of machines, for the retting method is both injurious to the fiber and tedious and expensive to the grower. After these machines have been operated for some time and the growers see the saving in the time and cost of preparing the fiber and observe the considerable improvement in the quality of the fiber and the increase in its price, they will be inclined to extend their plantings, and in course of time will need, and can afford to secure, similar machines to handle their crops.

KAPOK INVESTIGATIONS.

The status of the kapok industry in the Philippines remained unchanged until the latter part of the fiscal year covered by this report, during which period the efforts of this Bureau have succeeded in awakening the interest of some planters as well as that of the buyers and exporters. Correspondence has been carried on with the buyers of kapok in the United States and Europe, and the result has been in every case an increased interest in the Philippine product. All correspondence that was received in answer to ours was transmitted to the exporters of kapok in Manila for their information and action. Our efforts combined with those of the exporters here have succeeded in creating a demand that greatly exceeds the possible supply that can be expected under the present conditions.

Heretofore the principal reasons why so little kapok has been produced here for export purposes have been the ignorance of the producers as to the full merits of the fiber and also to the lack of suitable machinery for cleaning it. Efforts have been made

to eliminate the above reasons. Due publicity has been given to all the recent facts about kapok fiber and its merits.

Regarding the question of machinery, however, it can only be said at present that it has been only partially provided for. One machine has been in operation for a few years and has given fair results; another is now being experimented with, with fair prospects of success, and still another is, it is understood, under construction. The plans of this last mentioned machine were secured in Java by the fiber expert and were turned over to an engineering firm in Manila.

COTTON INVESTIGATIONS.

One of the principal lines of the activity of the fiber office during the fiscal year 1913 will be to carry on an extensive line of experiment work in cotton. These will include native species and types of cotton as well as others imported from the United States and Egypt.

A systematic study and investigational work with cotton has not yet been made; but from the preliminary investigation made during the past year, certain native types of cotton were found to exhibit such encouraging results that it was deemed, not only advisable, but also necessary, that a more detailed and more systematic investigation be carried on.

Through the coöperation of the demonstration and extension division, this division has been able to secure samples of lint and seed from the principal native species of cotton in Panay and Cebu, and also tentative descriptions and information about these species. The sample of seed and lint of the above mentioned, and other species secured by the fiber expert, have been sent to the United States Department of Agriculture at their request. Their tests and experiments, combined with the results which we hope to arrive at here, promise very interesting and important information about the cotton industry in general.

The object of the cotton investigation is to encourage the production of this crop in sufficient quantities to supply the local demand for raw cotton and yarn, and for the local manufacture of cheap cotton goods. The larger part of the importations of the first two classes and a large part of the third come from China and other eastern countries.

DEMONSTRATION AND EXTENSION DIVISION.

General Statement.—Extension work in the Bureau of Agriculture was first undertaken by the appointment on August 1, 1907, of a Superintendent of Agricultural Extension Work. For

three years this work was confined almost entirely to the investigation of agricultural conditions in different provinces. During the fiscal year 1911 a lecture campaign was organized and successfully carried out in eighteen provinces.

The work of this division during the fiscal year 1912 has been mainly directed toward the establishment of coöperative demonstration projects in several different provinces. Experience has shown that demonstration and extension work in these Islands, in order to be effective, must be concentrated within limited districts. The successful demonstrator is the one who is thoroughly familiar with existing local conditions and with the needs and desires of the people within the district in which he works. The greatest obstacle to be overcome in the development of this work is the securing of competent men who are willing to remain in one district a sufficient length of time to get results. An inspector in charge of a demonstration project should have not only a broad knowledge of agriculture, but also infinite resource and tact in his methods of dealing with the people. There will be a constantly growing demand for such men and it is important that new men receive a preliminary training before they are required to take entire charge of a district. The starting of demonstration projects with untrained men is bound to have disastrous results.

During the year covered by this report the demonstration and extension projects started during the latter part of the previous fiscal year in Cebu and Iloilo have been thoroughly organized and are now well established. New projects have recently been started in Batangas and Bohol. The seed distribution and elementary extension work carried on by one Filipino inspector in the subprovince of Amburayan have been continued throughout the year.

Central Office.—In the central office the work of the different field projects is correlated with a view of having uniform methods of procedure in all of the field work. The degree of success of the field work depends in a considerable measure on the constant support and assistance which the inspectors receive from the central office. It is extremely important that each inspector be frequently advised as to the work of all other inspectors in order that successful results in one province may be duplicated in others, and failures likewise avoided.

On March 1, 1912, the distribution of all printed matter of the Bureau, other than the regular mailing list of THE PHILIPPINE AGRICULTURAL REVIEW, was transferred to this division. This work has been thoroughly systematized and brought up to

a high degree of efficiency. A card index is now kept of all publications sent out and a permanent mailing list is being prepared. With the enlargement and improvement of our publications, the prompt and effective distribution of all printed matter of the Bureau is a work of growing importance and one that properly belongs to this division.

The preparation and installation of an agricultural-horticultural exhibit at the first Philippine Exposition, held in Manila in February, 1912, was supervised and in a large measure carried out by this division. With limited means available to work with, an exhibit was prepared that was entirely completed before the official opening of the exposition and that was awarded the first prize for Insular Government exhibits.

Field Work.—Owing to the severe drought which prevailed for about seven months in all of the provinces where demonstration work has been in progress conditions have been most unfavorable for this work. During the later part of the fiscal year, however, a large number of plots have been prepared and planted. This work has been limited to two or three of the more important staple crops, special attention having been given to corn.

A very encouraging feature of the demonstration work is the hearty coöperation that has been given by parties outside of the Bureau of Agriculture. The Philippine Railway Company has spared no effort to promote this work in every way possible, and commercial firms have contributed without charge implements and fertilizers. The farmers in the provinces where we have demonstration projects have shown entire willingness to coöperate and have furnished all of the land and labor required.

The following is a statement of the work carried on under the different field projects:

Cebu.—The Cebu demonstration and extension project was organized in April, 1911. Four months were spent in making a thorough inspection of the entire province. In the course of this inspection many farms were visited, seeds and bulletins were distributed and arrangements were made for starting coöperative demonstrations.

In October arrangements were made to carry on coöperative work with the Philippine Railway Company. Demonstration plots along the railway line were prepared but the severe drought which had started at this time prevented any further development of demonstration work until May and June. During these two months seventeen plots were prepared and planted to corn.

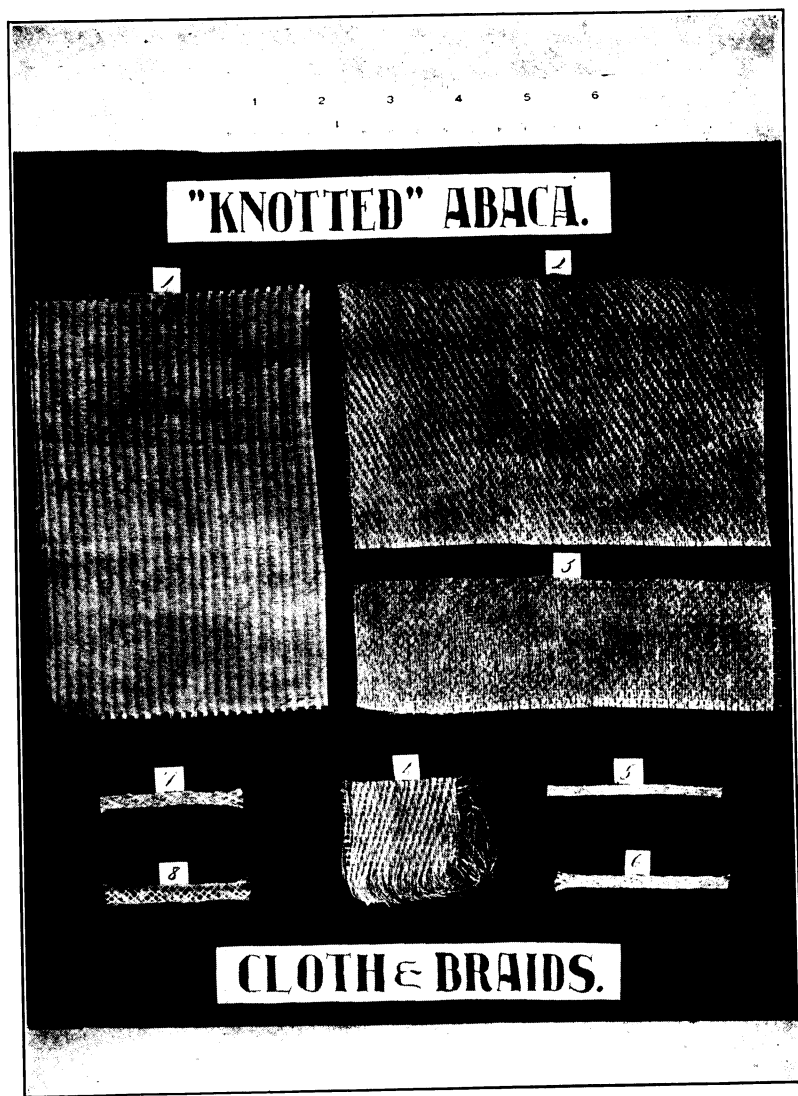


PLATE VI.—KINDS OF CLOTH AND BRAIDS MADE FROM "KNOTTED ABACA."
 With the exception of Nos. 4, 7, and 8, they are all made in Manila.



PLATE VII.—MANILA HEMP, BISAYA VARIETY OF OCCIDENTAL NEGROS.

Fourteen of these plots are on land owned by the railway and three are on private land. In addition to the corn plots one sugar-cane plot, four maguey plots and three rice plots have been planted in Cebu. Demonstration work with sweet potatoes, roselle, lima beans and vegetables is also being carried on in different municipalities.

During the period when the drought prevented planting of demonstration plots the inspector carried on several different lines of practical extension work. Illustrated lectures were given at regular intervals in the principal towns along the railway. The coöperation of the military officials in Cebu in the matter of utilizing corn-blade fodder was secured and a demonstration fodder project was worked out. Agricultural exhibits were prepared for the Carcar Industrial Exposition and for the First Philippine Exposition. An investigation was made of the cotton industry in Cebu Province and data on this subject furnished the central office. Demonstration work in seed testing and fumigation was carried on and extension circulars on agricultural subjects were prepared and distributed.

Iloilo and Capiz.—The Iloilo and Capiz demonstration and extension project was organized in March, 1911. The work in this district up to the close of the fiscal year 1911 was confined to the inspection of farms and lecture work in several municipalities.

During July, August and September the field inspection and lecture work were continued, a large part of the time of the inspector being required by the work of the Committee on the Award of Tobacco Bounties.

Active work was taken up in coöperation with the Philippine Railway Company and the farmers of these two provinces. Inspection trips were made and lecture work was carried on in both Iloilo and Capiz. In December demonstration work was started and plots were secured along the railway line in Capiz. Implements, seeds and fertilizers necessary for this work were obtained.

In March twenty-five demonstration plots had been secured in Iloilo and Capiz. This number was later increased to thirty-two and before the close of the fiscal year all of these plots were planted. Owing to the drought it was out of the question to do any planting until the rains commenced in May and June. The season being so far advanced before planting could be started the work on the demonstration plots has been confined almost entirely to one crop, corn. The method of procedure

followed has been to select the very best seed available and to plant in "check rows" at distances of 1 meter, thus allowing for cultivation both ways. Twenty-three thousand five hundred ears of selected seed corn were purchased by the Bureau inspectors and paid for by the Philippine Railway Company. This corn was used on the demonstration plots, was distributed gratis to farmers planting under instructions, and was sold to others at the cost price of ₱2 per hundred ears. All of this seed was fumigated, thoroughly dried and tested. The distribution of this large amount of selected seed corn can not but result in much more extensive planting of this valuable crop, in fact that result has been, in a measure, already obtained.

In addition to field inspections, lectures, tobacco bounty work and the planting of demonstration plots, several other special lines of work have been carried on. A thorough investigation was made of the cotton industry in Iloilo and Capiz. The possibilities for developing cotton growing were found to be good. The seed of the best local variety was obtained and distributed. The use of dust sprays on tobacco fields was demonstrated in several different places. Many hundreds of packages of vegetable and flower seeds and a large number of bulletins and circulars have been distributed. Three hundred grape cuttings were obtained from Cebu and planted at Passi, Iloilo. Cowpeas and soybeans obtained from the La Carlota station have been planted on several of the demonstration plots.

Plans are now being prepared for the establishment of a demonstration station in Iloilo and for the development of the coöperative demonstration in both Iloilo and Capiz Provinces.

Batangas.—An inspector was detailed in charge of the demonstration and extension project in Batangas Province in March, 1912. The province at that time was suffering from one of the most severe droughts of recent years. The inspector first made a preliminary inspection of this territory, distributed seeds and publications and made arrangements for starting coöperative demonstrations as soon as weather conditions would permit. The farmers of Batangas showed a commendable interest in this work and but little difficulty was experienced in obtaining coöperators and demonstration plots in the different municipalities visited. By the end of April, thirteen coöperators had been secured in twelve different municipalities. The demonstration plots had been laid out and the necessary implements, seeds and fertilizers were ready for use. During May, nine of these demonstration plots were prepared for planting and five

plots were planted. This work was pushed as rapidly as weather conditions would permit up to the close of the fiscal year. Corn and rice are the two crops that have thus far been planted on the Batangas demonstration plots. Sugar cane will be planted in the sugar districts of this province at a later date.

Mountain Province.—Seed distribution and a limited amount of extension work have been carried on in the subprovince of Amburayan throughout the year by a Filipino inspector. This work has necessarily been elementary in character, but reports received indicate that it has been of considerable practical benefit to the people of Amburayan. Arrangements have been perfected for establishing a demonstration project in the Mountain Province under the supervision of an experienced American inspector. This project will be started early in the fiscal year 1913. The keen interest that is taken by the local officials in the Mountain country in the improvement of agriculture, together with the favorable attitude of the people toward the work of this Bureau augurs well for the success of this project.

Bohol.—A demonstration and extension project was started in Bohol in May, 1912. During May and June the inspector was occupied in making a preliminary inspection of the province in the vicinity of Tagbilaran, assisting in the work of laying out school gardens and in locust work. Considerable interest has been shown by the people of this province in coöperative demonstrations and there appears to be a satisfactory field for the establishment of this work in Bohol.

Conclusion.—The field for the development of demonstration and extension work in these Islands is practically unlimited. As rapidly as available funds and men will permit there should be established a demonstration and extension project in each province in the Islands. The practical value of this work has been fully proven in other countries where the demand for such work is less urgent than it is in the Philippine Islands. The greatest difficulty which the Bureau of Agriculture has experienced since its organization has been in finding suitable means for transmitting to the farmers the results of investigational work in such a way as to bring about definite and positive improvement in agricultural methods. This want should be, in a large measure, supplied by the development of our coöperative demonstrations.

DIVISION OF PUBLICATIONS.

The work of this division comprises the following: The publication of THE PHILIPPINE AGRICULTURAL REVIEW, bulletins, circulars, etc., the supervision of the Bureau of Agriculture library,

Bureau planotype work, and miscellaneous translations for the Bureau.

THE PHILIPPINE AGRICULTURAL REVIEW.

The preparation of material for, and the publishing and distribution of the REVIEW constitute the greater part of the work in the division of publications. In this connection attention has been given during the year to the following lines of work:

Subject Matter.—Special effort has been made to provide live articles of interest and of distinct advantage to agriculturists of all classes throughout the Philippine Islands, and to bring the farmers more closely in touch with the work of this Bureau. An extremely wide field has been covered and it is believed that manifest advancement has been made with respect to this particular feature.

Elimination of "Clipped" Material.—At the beginning of the fiscal year steps were taken to do away with, as far as possible, the reprinting of articles, either in whole or in part, which had already appeared in other publications. The success attained may be seen from the fact that the REVIEW, as it stands to-day, is wholly composed of original articles, written to a greater extent than ever before by members of this Bureau. Efforts to obtain a greater number of contributions from the field employees of the Bureau have met with some success, although the central office staff is still depended upon for the bulk of the material. There is much room for improvement along this line, and it is hoped that during the coming fiscal year the field men of the Bureau will contribute to the pages of the REVIEW to a much greater extent.

Special Numbers.—An important feature of the REVIEW work has been the publishing of "special numbers," each of which has been devoted mainly to one subject. During the fiscal year five such numbers have appeared, as follows: August, 1911, "Forage;" September, 1911, "Live Stock;" January, 1912, "Annual Report of the Director of Agriculture;" April, 1912, "Philippine Exposition;" May, 1912, "Coconuts." Such a wealth of material has presented itself that it has been deemed feasible to devote every other number of the REVIEW to some one subject, making six special numbers during the year. Among special numbers contemplated in the near future are, "Economic Horticulture," "Ornamental Horticulture," and "Veterinary subjects."

Exchanges.—During the latter part of the year special effort has been made to increase our list of exchanges so as to include

all of the leading agricultural periodicals throughout the world. Many new publications of this nature have already been received and favorable replies to our requests for exchanges are continually coming in. A noteworthy feature in this connection is the increasing number of references to and clippings from the REVIEW which are appearing in periodicals already on our exchange list.

Distribution.—The number of copies of the REVIEW, including both English and Spanish editions, sent out during this year has remained approximately the same as for last—something over six thousand, making a total distribution for the twelve months of more than seventy-two thousand copies. Whenever possible “dead material” in the mailing list has been eliminated, and names of people substituted therefor who it was reasonably certain would make an intelligent and advantageous use of the REVIEW. This work has been in the hands of the librarian, but beginning with the fiscal year 1911-12 it will be taken over by the superintendent of publications.

The Review on a Subscription Basis.—Owing to the present cost of the REVIEW, to the already large mailing list, to the lack of information in regard to the status of many people on this list, and to the large number of requests for the REVIEW received from persons whose status is not known, it has become more and more evident that this publication should be placed on a subscription basis. Beginning July 1, 1912, free copies will be sent to a limited number of officials chosen to include every town in the Islands, and all persons desirous of obtaining the Review who are not in this list will be required to pay therefor an annual subscription of ₧2. This subscription price covers only a part of the actual cost of the REVIEW, so that the Bureau of Agriculture is still bearing a portion of the expense of publication. Through the free copies sent out people unable to pay for the REVIEW can still have access to this publication. On the subscription basis anyone can now obtain the REVIEW, whereas, under the former arrangement, many had to be refused.

OTHER PUBLICATIONS.

These include bulletins, circulars and reprints from the REVIEW.

Bulletins.—Subject matter requiring extended or technical treatment is published in the form of a bulletin.

Circulars.—Important matter, for various reasons unsuited for articles in the REVIEW, and requiring less detailed treatment than that of a bulletin, is issued in the form of printed or planotyped circulars.

Reprints.—Articles of special interest appearing in the REVIEW are often reprinted and these reprints distributed as circulars.

Following is a list of bulletins, circulars and reprints which have been issued during the fiscal year 1911–1912:

Subject.	Author.	Copies.		
		Eng-lish.	Span-ish.	Local dialect.
BULLETINS.				
No. 18. "The Mango"-----	P. J. Wester-----	1,000		
No. 19. "Experiments on the Efficiency of Anti-Rinderpest Serum."-----	A. R. Ward and F. W. Wood.-----	1,000		
No. 20. "Notes on the Muscular Changes Brought about by Intermuscular Injection of Calves with the Virus of Contagious Pleuropneumonia."-----	W. H. Boynton-----	1,000		
No. 21. "A Study of the Normal Blood of Carabao."-----	W. H. Boynton-----	1,000		
Special. "The Sugar Industry of the Philippine Islands."-----	G. E. Nesom, four collaborators.-----	1,000		
Special. "A Handbook on the Sugar Industry of the Philippine Islands."-----	G. E. Nesom, H. S. Walker, three collaborators.-----	500	1,000	
CIRCULARS.				
No. 2. "El Semillero de Tabaco"-----	R. W. Rowe-----		1,000	
No. 5. "The Tobacco Beetle"-----	D. B. Mackie-----	a500	a500	
No. 6. "Cultural Directions for Papaya"-----	P. J. Wester-----	1,000		
Tagalog-----				1,000
Cebuano-----				1,000
No. 7. "Coconuts"-----	O. W. Barrett-----	1,000	1,000	
Tagalog-----				1,000
Pangasinan-----				1,000
Cebuano-----				1,000
English-----		a500		
No. 8. "Locusts"-----	D. B. Mackie-----	a500	a1,000	
No. 9. "Directions for Planting Vegetables and Flowers."-----	P. J. Wester-----	a500	a500	
Tagalog-----				1,000
Ilocano-----				1,000
Pangasinan-----				1,000
Cebuano-----				1,000
No. 10. "Directions for Planting Forage Seeds and Roots."-----	O. W. Barrett-----	a1,000		
No. 11. "Seed Cane Distribution"-----	O. W. Barrett-----	a200	a500	
No. 12. "Plant Pest Remedies"-----	P. J. Wester-----	1,000	500	
No. 13. "Rats"-----	D. B. Mackie-----	1,000		
No. 14. "Corn-blade Fodder"-----	C. M. Conner-----		2,500	
No. 15. "The Mango"-----	P. J. Wester-----		a800	
			1,500	
REPRINTS.				
"The Rinderpest Problem"-----	A. R. Ward-----	100		
"The Propagation of the Avocado"-----	P. J. Wester-----	200		

^a Planotype.

LIBRARY.

During the fiscal year 1911–12, the library work has consisted of the care of the books, periodicals, pamphlets, etc., planotype work, the addressing and mailing of THE PHILIPPINE AGRICULTURAL REVIEW, and, until March 1, 1912, the distribution of the Bureau bulletins and circulars. Since March 1, the library has been receiving a general overhauling, which up to this time had been impracticable through press of other duties. Some work has been done in the way of general indexing. Very few

new books have been purchased during the fiscal year, although a great number of missing numbers of the United States Department of Agriculture reports, bulletins, etc., have been obtained.

DIVISION OF STATISTICS.

GENERAL WORK.

The work of this division includes the collection of statistical data regarding crops and live stock in the Philippine Islands, the tabulation of these data, and the preparation of statistical material for publication and distribution. Statistics are obtained from the following sources: Quarterly crop and live-stock reports, furnished by municipal presidents; semiannual animal lists, furnished by municipal presidents; and the monthly summary of crop conditions furnished by provincial governors.

The routine work of this division for the fiscal year 1912 has been almost entirely confined to the handling of the crop reports and animal lists.

Previous to November 8, 1911, a crop report was returned for correction accompanied by a letter. Since that date each crop report has been accompanied by an error sheet (sometimes two or three pages) and the records of the division show that 1,119 of these error sheets have been sent out up to June 30.

An accurate register is kept of the arrival of crop reports and animal lists, of their return for correction, of their rearrival, of their approval and of any correspondence connected therewith, so that it has been possible to tell with positiveness the exact status and location of each document.

A considerable portion of the labor of the division consists in copying the data from the quarterly crop reports on large sheets where it can be tabulated by crop and by province. Great care has been used this year to see that the figures are copied correctly and that the crops show reasonable production per hectare.

These large tabulation sheets contain the names of all the seven hundred and twenty-six municipalities, eighty-three townships, two cities, nineteen rancherias and eleven settlements (eight hundred and forty-one localities in all) which report to the Bureau of Agriculture.

A similar set of tabulation sheets is used for the data relating to the animals listed on the quarterly crop reports. A separate set of sheets is used for the animals listed on the semi-annual animal lists.

The tabulation of the data for the fiscal year 1911 was completed in time to prepare graphic maps and charts for the

Exposition in February. These maps and charts attracted considerable attention at the Exposition from those interested in statistics, especially from the Manila Merchants' Association, which immediately requested copies.

The division of statistics has been able on several occasions to furnish valuable data to various persons and organizations. In December, 1911, such data were furnished the "Rice Committee." The Manila Merchants' Association has been furnished maps, charts and tabulated sheets showing the status of the various crops. Individuals preparing material for publication, representing foreign consuls, commercial houses, and newspapers, have also been furnished material.

FIELD WORK.

Throughout most of the year a representative of the division has been traveling in the provinces. This inspector has visited the offices of municipal presidents and secretaries and inspected their retained copies of quarterly crop reports, semi-annual animal lists and annual crop statements. He has invited the attention of the municipal presidents to the requirements of law regarding their reports and explained in detail to them the system of crop reporting and animal listing, and has attended annual meetings of municipal presidents in their provincial capitals.

DIVISION OF MACHINERY AND CONSTRUCTION.

PANDACAN FORAGE FACTORY.

Operation.—The output from this factory of finished forage products was not as large this year as that of the pervious year on account of the small crop of corn produced during August and September and the almost total failure of the May corn crop. As a result high prices have prevailed during the greater part of the year. In order to fill the regular orders for feed, bids were advertised for by the Bureau of Supply, with a view to having corn imported to tide over until another crop could be harvested. The prices submitted with these tenders were all so high that the plan was abandoned and all outside orders were cancelled.

Oats were purchased and together with Manchurian bean meal and bran were turned into a grain ration which kept the stations pertaining to this Bureau supplied.

The grain ration, known as No. 14, made up at this factory consists of 61.5 per cent of corn meal, 15 per cent of Manchurian

bean meal, and 23.5 per cent of wheat bran, forming a grain ration about equal to oats, but for feeding quality surpassing oats, according to several verbal reports made by parties who use this feed. Many claim that it is better than any imported mixed grain ration, basing their opinion on the condition of their stock. This mixture has been used principally for horse and mule feed; however, equally good results have been obtained in feeding it to cattle, hogs and poultry.

New Machinery.—In order to fully equip the factory additional machinery was ordered and is now being installed. This machinery consists of one Nordyke and Marmon 30-inch French buhr grinder, one large western elevator sheller, and one large "Bentall" corn and oats crusher. The last-mentioned machine is principally for rolling oats, the best known method of preparing them for stock feed. With this equipment the capacity of the factory is more than doubled and large orders can be handled expeditiously.

The Hart-Parr petroleum motor that has been used as a traction engine has been dismounted and installed as a stationary motor for additional power; 50 to 60 tons of mixed feed can now be handled daily.

Products.—The corn used at the forage factory was all purchased in Laguna, Batangas, Rizal and Bulacan Provinces and delivered on the ear, husked. After it is received it is then spread on the floor to dry out and when dry enough it is shelled, ground up and converted into stock feed. Sixty thousand three hundred forty-nine kilos of corn meal have been sold. The increasing demand for this article and for mixture No. 14, which contains 61.5 per cent of corn meal, justifies the belief that in the near future the farmers of the Philippines will produce and supply the bulk of the more than ₱2,000,000 worth of stock feed that is annually consumed in these Islands. This money will then go into the farmers' pockets instead of having to be sent out of the Islands, as is done at the present time.

REPAIR SHOP.

The blacksmith shop maintained for the forage factory was often called upon to do job work for other stations, as the work could be done more quickly and economically than in other repair shops. This work increased until it was found necessary to establish a repair shop. The building formerly used as a store-room was set aside for this work, a small lathe, saw, emery-stone, and drill were installed and driven from a line shaft by a 20

horsepower electric motor. A mechanic with helpers was employed and at present all the motorcycles, automobiles, bicycles, launches, farm machinery, and common office furniture belonging to the Bureau of Agriculture are repaired in this shop. Besides having the work more expeditiously performed, a saving of from 10 to 50 per cent is made in work performed here instead of having it done in other shops. Mechanics are sent out from this shop to repair machinery located at the stations.

STEAM COPRA DRYER.

One of the products of the repair shop is a steam copra dryer, designed by the machinery expert of this Bureau from a rough sketch furnished by the division of horticulture. This dryer was entirely constructed at the repair shops. The capacity of this dryer is about 3,000 nuts per day. The dryer was taken direct to the Exposition grounds where it was assembled and put in operation. Not having been previously tested many prominent copra producers inspected the working of the dryer, and the copra produced, and where quite well satisfied as to results obtained. A boiler has been requisitioned for use with this dryer and further experiments will be carried out in order to bring the dryer up to its highest state of efficiency.

MOTOR PLOWING.

Several requests have been received from farmers desiring the use of a motor plow. As the only plowing tractor the Bureau now owns is the Hart-Parr kerosene motor, and as the performance of this machine in the past had not been very satisfactory, it was decided to take the motor and plow to a farm in Muntinlupa, Rizal, near Alabang, and thoroughly test it out. This work was carried out during the month of November. In all about twenty hectares of land were plowed, the majority being old sugar-cane land. Some old rice land was also plowed, the top of the ridges being picked off before plowing. The motor itself had ample power, but the principal weakness developed in the frame.

The tests have developed the following facts: that the motor is strong and has ample power, that the frame is too light, needs heavy plates, and braces in the main frame.

CONSTRUCTION.

This division designed and constructed the temporary sheds for housing the live stock and poultry at the Philippine Exposition held in Manila February, 1912.

The residence and office at the Singalong experiment station were repaired and repainted, and a rat-proof seed storeroom was constructed on the ground floor. Some repairs were made and concrete floors laid in the barns and harness room.

There was constructed at Singalong experiment station a small building 12 by 16 by 8 feet (3.65 by 4.87 by 2.43 meters) high, with concrete floor and galvanized iron roof with sides of the same material to the height of 3 feet 6 inches (1.06 meters) and the upper parts made of $\frac{1}{2}$ -inch (1.27 centimeters) mesh poultry netting. A concrete gutter 6 by 6 inches (15 by 15 centimeters) extends entirely around the building, making it ant and rat proof. This building was constructed for the entomologist to use in experimenting with locusts. The approximate cost was ₱400.

At the Alabang stock farm a reinforced concrete silo was constructed with dimensions 16 feet (4.87 meters) diameter inside and 28 feet (8.53 meters) high. The sides are 4 inches (10.16 centimeters) thick and 5 inches (12.7 centimeters) at the base. This was placed 5 feet (1.52 meters) in the ground on a foundation of good dhobie rock. The roof was made of 1 inch (2.54 centimeters) sheeting overlaid with plain galvanized iron. The capacity is approximately one hundred tons of ensilage. A No. 16 Ohio Monarch ensilage cutter with blower was sent from the forage factory and installed. The cost of the silo was approximately ₱750.

A 7,000-gallon reinforced-concrete water tank was built on the hill back of the research laboratory at Alabang as a supply for the laboratory, stock sheds, and barrio. This has been connected with the windmill, but poor service was rendered by this mode of pumping and a motor driven pump should be installed to insure a sufficient water supply.

A small centrifuge designed and made by the Bureau of Navigation was installed together with a three-horsepower Ferro motor, in the Alabang research laboratory. This has been in operation for some time and has given satisfaction. New doors and windows throughout, of seasoned Ipil and Banuyo, were made at the repair shop and installed in the laboratory to replace the old ones that had been made from unseasoned and inferior qualities of lumber, and with which it was impossible to keep out the rain. Some general repairs to buildings and sheds pertaining to the laboratory were also made.

A concrete dipping tank was constructed for the Iloilo quarantine station. This tank is 8 feet (2.43 meters) wide by 6

feet (1.82 meters) deep and 40 feet (12.19 meters) in length over all. The walls are 4 to 6 inches (10.16 to 15.24 centimeters) thick. The design is similar to the tanks in use in the United States. The cost was approximately ₱350.

RECOMMENDATIONS.

The urgent need of giving first attention to the control and eradication of animal diseases and the large expenditure required to carry on this work have resulted in the partial neglect of other important lines of work that should be undertaken by this Bureau. It is imperative that the animal disease campaign be continued and it will not be practicable to make any immediate reduction in the cost of this work. In view of the importance of agriculture in these Islands it is felt that the Bureau of Agriculture should receive such consideration as will make it possible not only to continue the animal disease campaign but also to develop other lines of constructive agricultural work.

It is desirable that special provision be made for developing coöperative field demonstration. This work is eminently practical and should be the most effective means of improving agricultural conditions in the Islands.

There is pressing need of uniform and comprehensive legislation defining the powers and duties of the Director of Agriculture in connection with the control and eradication of diseases of live stock.

Very respectfully,

F. W. TAYLOR,
Director of Agriculture.

The Honorable,
the SECRETARY OF PUBLIC INSTRUCTION,
Manila, P. I.

GENERAL AND STATISTICAL TABLES.

No. 1.—*List of directing and superintending officers.*

(August 1, 1912.)

FREDERIC W. TAYLOR, *Director of Agriculture.*

H. T. EDWARDS, *Assistant to the Director.*

DIVISIONS.

Divisions.	Chief of division.
Clerical	W. E. Cobey.
Finances and property	T. R. Flack.
Animal husbandry	F. C. Gearhart.
Veterinary	A. R. Ward.
Agronomy	C. M. Conner.
Horticulture	O. W. Barrett.
Fiber	M. M. Saleeby.
Demonstration and extension	H. T. Edwards.
Publications	S. Stickney.
Statistics	B. P. Lukens.
Machinery and construction	Z. K. Miller.

STATIONS AND FARMS.

Station or farm.	Superintendent.
Alabang stock farm	H. F. Hungerford.
Trinidad stock farm	A. L. Bradley (acting).
Trinidad garden	A. M. Burton.
La Carlota experiment station	H. J. Gallagher.
Lamiao experiment station	F. C. Kingman (acting).
Singalong experiment station	W. N. Birch.
Ilagan tobacco station	R. W. Rowe.

No. 2.—*Animals purchased by the division of animal husbandry during the fiscal year 1912.*

Kinds.	Number of purchases.	Number purchased.	Average price of each.	Total price.
Native ponies	53	61	P171.08	P10,435.88
Australian and American horses	12	21	302.57	6,353.97
Work bullocks	9	62	106.51	6,603.62
Experimental cattle	10	173	47.90	8,286.70
Experimental carabaos	3	58	101.82	5,905.56
Work carabaos	2	2	150.00	300.00
Sheep	1	5	6.00	30.00
Goats	1	10	6.20	62.00
Deer	1	3	26.66	79.98
Swine	1	2	1.75	3.50
Monkeys	4	34	2.00	68.00

No. 3.—*Buyers and classes of animals sold by Bureau of Agriculture during the fiscal year 1912.*

	Horses.		Mules.		Burros.		Cattle.	
	Num-ber.	Price.	Num-ber.	Price.	Num-ber.	Price.	Num-ber.	Price.
Other Bureaus	18	P4,367.00	2	P630.76	3	P150.00	4	P3,766.00
Provinces	7	3,054.40					62	6,230.40
City of Manila	33	6,551.20	1	400.00				
Municipalities							2	198.00
Private sales	6	315.00			2	100.00	52	2,585.00
Auction sales	78	7,928.00					191	7,792.00
United States Army								
Total	142	22,215.60	3	1,030.76	5	250.00	311	20,571.40

	Carabaos.		Sheep.		Goats.		Swine.		Guinea pigs and rabbits.	
	Num-ber.	Price.	Num-ber.	Price.	Num-ber.	Price.	Num-ber.	Price.	Num-ber.	Price.
Other Bureaus	1	P150.00					3	P105.00		
Provinces					4	P40.00	9	315.00		
City of Manila							2	70.00		
Municipalities	6	330.00			31	142.00	29	1,015.00	2	P8.00
Private sales	43	2,945.50	2	P10.00	27	65.20	24	334.00		
Auction sales										
United States Army									a 6	
									b 12	90.00
Total	50	3,425.50	2	10.00	62	247.20	67	1,839.00	20	98.00

^a Guinea pigs.^b Rabbits.

No. 4.—*Origin and price of animals sold during the fiscal year 1912.*

Animals.	Obtained by purchase.		Alabang stock farm.		Trinidad stock farm.		La Carlota experi-ment station.	
	Num-ber.	Price.	Num-ber.	Price.	Num-ber.	Price.	Num-ber.	Price.
Horses	54	P13,072.60	65	P5,754.00			22	P3,089.00
Mules			1	400.00				
Burros								
Cattle	62	7,264.40	120	4,250.50	18	P1,025.00	30	1,794.00
Carabaos							8	923.00
Sheep			2	10.00				
Goats			51	169.00			4	24.50
Swine	2	5.50	47	1,343.50			9	175.00
Guinea pigs								
Rabbits								
Total	118	20,342.50	286	11,927.00	18	1,025.00	73	6,005.50

Animals.	Lamoa ex-periment station.		Ilagan to-bacco station.		Singalong experiment station.		Alabang research labo-ratory.		Central office.	
	Num-ber.	Price.	Num-ber.	Price.	Num-ber.	Price.	Num-ber.	Price.	Num-ber.	Price.
Horses			1	P300.00						
Mules					2	P630.76				
Burros									5	P250.00
Cattle							105	P5,917.50	2	320.00
Carabaos							42	2,502.50		
Sheep									4	40.00
Goats	3	P13.50							2	70.00
Swine	2	70.00	5	175.00						
Guinea pigs							14	56.00		
Rabbits							6	42.00		
Total	5	83.50	6	475.00	2	630.75	167	8,518.00	13	680.00

NOTE.—Twenty-three horses and two mules valued at P3,590 were transferred from the division of animal husbandry to the veterinary division.

No. 5.—*Location and number of Bureau of Agriculture animals born during the fiscal year 1912.*

Kinds.	Alabang stock farm.	La Carlota experiment station.	Trinidad stock farm.	Lamiao experiment station.	Ilagan tobacco station.	Alabang research laboratory.	Total.
Horses	28	10	7				45
Burros				3			3
Cattle	63	39	37				139
Carabaos		7					7
Sheep	6			1			7
Goats	48	9		8			65
Swine	100	12		12	9		133
Rabbits						95	95
Guinea pigs						468	468

No. 6.—*Bureau of Agriculture animals dying during the fiscal year 1912.*

Kinds.	Singalong experiment station.	Alabang stock farm.	La Carlota experiment station.	Trinidad stock farm.	Lamiao experiment station.	Alabang research laboratory. ^a	Other places.	Total.
Horses		5	6	4		11	4	30
Mules						2	2	4
Burros					1	1		2
Cattle		11	6	21		134		172
Carabaos			2			26		28
Sheep	1	3	1		4			9
Goats	1	5	3		19	8		36
Swine	2	22	6		4		2	36
Monkeys						14		14
Rabbits						86		86
Guinea pigs						468		468

^a These animals were used for experimental purposes, thus accounting for the large number of deaths.

No. 7.—*Public live-stock breeding.*

Location and time.	Number of mares bred.	Number of services.	Stallion.
Singalong experiment station:			
September 1, 1911, to June 30, 1912	16	16	Arabian "Hatim" No. A-21.
November 1, 1911, to March 1, 1912	1	1	Arabian "Vedas" No. 121.
July 1, 1911, to June 30, 1912	1	1	Native No. 96.
Alabang, Rizal:			
July 1, 1911, to June 30, 1912	7	7	American "Handrail" No. A-107.
September 1, 1911, to June 30, 1912	2	2	Arabian "Hamayoon" No. 126.
April 25, 1912, to June 30, 1912	3	3	Arabian "Karrar" No. 119.
La Carlota experiment station, July 1, 1911, to June 30, 1912	14	22	Arabian "McQueen" No. 118.
Baguio stock Farm, July 1, 1911, to June 30, 1912	4	4	Arabian "Mestizo Moscow" No. B-102.
Ilagan, Isabela:			
October 15, 1911, to April 8, 1912	7	7	Native No. 93.
March 1, 1912, to June 30, 1912	14	14	American "Handmole" No. 864.
Iloilo, Iloilo, July 1, 1911, to June 30, 1912	5	10	American "Sargent" No. A-105.
Virac, Catanduanes:			
July 1, 1911, to June 30, 1912	91		American "Duke of Albany."
July 1, 1911, to June 30, 1912	42		Arabian "Cross" George N. No. B-12.
July 1, 1911, to June 30, 1912	20		Arabian "Pharaoh" No. 40.
October 1, 1911, to June 30, 1912	15		Arabian "Mestizo Buck" No. A-121.
July 1, 1911, to October 12, 1911	10		Native No. 116.
Bagamanoc, Catanduanes:			
October 20, 1911, to June 30, 1912	33	33	Native No. 166.
October 20, 1911, to June 30, 1912	35	35	Native No. 184.
October 20, 1911, to June 30, 1912	64	65	Native No. 116.
October 20, 1911, to June 30, 1912	55	55	Native No. 117.

No. 7.—*Public live-stock breeding*—Continued.

Location and time.	Number of mares bred.	Number of services.	Stallion.
Tanauan, Batangas:			
July 1, 1911, to July 31, 1911	6	8	Arabian "Balmoral" No. 120.
July 1, 1911, to July 31, 1911	4	5	Arabian "Noureddin" No. 122.
July 1, 1911, to July 31, 1911	5	7	Arabian "Vedas" No. 121.
July 1, 1911, to July 31, 1911	0	0	Native No. 185.
San Jose, Batangas:			
August 1, 1911, to September 14, 1911	9	11	Arabian "Balmoral" No. 120.
August 1, 1911, to September 14, 1911	10	13	Arabian "Noureddin" No. 122.
August 1, 1911, to September 14, 1911	12	13	Arabian "Vedas" No. 121.
August 1, 1911, to September 14, 1911	3	3	Native No. 185.
Lipa, Batangas:			
September 15, 1911, to November 30, 1911	15	18	Arabian "Balmoral" No. 120.
September 15, 1911, to November 30, 1911	13	13	Arabian Noureddin No. 122.
September 15, 1911, to November 30, 1911	19	19	Arabian "Vedas" No. 121.
September 15, 1911, to November 30, 1911	19	20	Native No. 185.
Tiaong, Tayabas:			
December 22, 1911, to March 4, 1912	6	9	American saddle horse "Chester Jr." A-106.
December 22, 1911, to March 4, 1912	4	7	Arabian "Karrar" No. 119.
December 22, 1911, to March 4, 1912	4	7	Native No. A-28.
Candelaria, Tayabas:			
March 4, 1912 to March 25, 1912	6	12	American saddle horse "Chester Jr." A-106.
March 4, 1912, to March 25, 1912	7	14	Arabian "Karrar" No. 119.
March 4, 1912, to March 25, 1912	5	9	Native No. A-28.
Sariaya, Tayabas:			
March 25, 1912, to April 22, 1912	8	14	American saddle horse "Chester Jr." A-106.
March 26, 1912, to April 22, 1912	5	10	Arabian "Karrar" No. 119.
March 26, 1912, to April 22, 1912	3	5	Native No. A-28.
Lucena, Tayabas:			
April 22, 1912, to June 20, 1912	0	0	American saddle horse "Chester Jr." A-106.
April 22, 1912, to June 20, 1912	0	0	Native No. A-28.
San Fernando, Union:			
August 10, 1911, to December 22, 1911	2	2	American "Highball" No. B-1.
August 10, 1911, to October 10, 1911	0	0	Arabian "Sakara" No. 123.
August 10, 1911, to October 10, 1911	5	5	Arabian "Hassan" No. 73.
Tagudin, Mountain Province, December 24, 1911, to June 11, 1912	20	34	American "Highball" No. B-1.
Vigan, Ilocos Sur:			
October 14, 1911, to December 1, 1911	1	1	Arabian "Sakara" No. 123.
October 14, 1911, to June 30, 1912	28	44	Arabian "Hassan" No. 73.
Laoag, Ilocos Norte:			
December 2, 1911, to April 18, 1912	22	38	Arabian "Sakara" No. 123.
May 20, 1912, to June 30, 1912	1	2	Arabian "Sakara" No. 123.
Bangui, Ilocos Norte, April 20, 1912, to May 12, 1912	8	15	Arabian "Sakara" No. 123.
Bangued, Abra, June 12, 1912, to June 30, 1912	2	3	American "Highball" No. B-1.
Larena, Siquijor, March 12, 1912, to June 30, 1912	23	31	Arabian "Vedas" No. 121.
Location and time.	Number of sows bred.	Boar.	
Virac, Catanduanes, September 25, 1911, to June 30, 1912	-----	Berkshire boar No. 39.	
Ilagan, Isabela, October 15, 1911, to June 30, 1912	3	Berkshire boar No. A-31.	
Singalong experiment station:			
July 1, 1911, to September 10, 1911	7	Berkshire boar No. 20.	
September 15, 1911, to October 1, 1911	2	Berkshire boar No. A-31.	
October 2, 1911, to June 30, 1912	16	Berkshire boar No. 62.	

No. 8.—*Number, by classes, and location of Bureau of Agriculture animals
June 30, 1912.*

Location.	Horses.	Mules.	Burros.	Cattle.	Carabaos.	Swine.	Goats.	Sheep.
Alabang stock farm	97	8		184		57	61	14
Trinidad stock farm	4			95				
La Carlota experiment station	43	1		108	20	7	14	1
Alabang research laboratory	13		1	55	8		6	7
Singalong experiment station	12	7				1	1	
San Lazaro immunizing station				2	3			
Pandacan quarantine station				12				
Lamiao experiment station	1		8	4		10		
Ilagan tobacco station	4			1	4	7		
Iloilo quarantine station	1			3			1	
Provincial breeding station	14							
Provincial veterinary force	56	15						
Moro Province	8							
Subprovince of Bukidnon				10		1		
Trinidad garden	1	4		6				
Tarlac Province	1							
Total	255	35	9	480	35	83	83	22

No. 9.—*Inspections at the port of Manila for the fiscal year ending
June 30, 1912.*

Ports of embarkation.	Number on arrival.		Shipped to prov- inces.		Deaths.	
	Cattle.	Carabaos.	Cattle.	Carabaos.	Cattle.	Carabaos.
Pnum Penh	7,668	1,579	5,586	1,401	16	39
New Caledonia	505				3	
Australia	181		91			
Formosa	1,471	211	999	209	186	
Native	1,790	874	1,061	710	12	
Dilly Timor	80	115	46	112	4	3
Total	11,695	2,779	7,783	2,432	221	42

No. 10.—*Inspections at port and city of Manila during fiscal year ending
June 30, 1912.*

Kinds of animals.	Inspected on arrival.				Arrived from—		Shipped to prov- inces.
	Total number.	With- out fees.	Rate per head.	Fees col- lected.	Foreign ports.	Philip- pine ports.	
Cattle	13,245	81	P0.20	P2,632.80	11,309	1,936	8,205
Carabaos	2,886	45	.40	1,136.40	1,906	980	3,213
Horses	2,923	733	1.00	2,190.00	743	2,180	1,060
Hogs	67,983	48	.10	6,793.50	2	67,981	101
Sheep	269	16	.20	50.60	75	194	36
Goats	780	32	.20	149.60	7	773	66
Other animals	120		.40	48.00	24	96	4
Total	88,206	955		13,000.90	14,066	74,140	12,685

REMARKS.—81 cattle, 45 carabaos, 48 hogs, 16 sheep, and 32 goats admitted free on arrival (civil government); 733 horses admitted free on arrival (civil and military government); 25 horses condemned for glanders; 2 horses condemned for surra.

No. 11.—*Live stock passing through Pandacan quarantine station during fiscal year ending June 30, 1912.*

	Cattle.	Carabaos.
On hand July 1, 1911	1,670	330
Received during year	6,539	2,527
Slaughtered in Pandacan	1,781	
Died in station	261	126
Released	5,960	2,040
On hand June 30, 1912	207	31

No. 12.—*Post-mortem inspections in Manila abattoir during fiscal year ending June 30, 1912 (includes kill at Pandacan).*

Kinds of animals.	Passed for food.	Con-demned.	Total.
Cattle	4,953	42	4,995
Calves	1		1
Sheep	17		17
Goats	1,233		1,233
Swine	70,080	980	71,060
Deer	2		2
Total	76,336	1,022	77,358

No. 13.—*Condemnations in Manila abattoir during fiscal year ending June 30, 1912.*

Causes.	Cattle.		Swine.		Sheep.		Goats.		Deer.	
	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.
Tuberculosis	8	167	15	363						
Rinderpest	22									
Septicemia	2		4							
Cysticercus			875							
Hog cholera			25	52						
Icterus			4							
Empyoma	1	3		1						
Tumors and abscesses	1	11		17						
Extreme emaciation			18							
Injuries, bruises, etc		14		120						
Foot-and-mouth disease		1,700								
Parasitic infestation and cirrhosis		50		632				6		
Dead and dying condition	8		29							
Miscellaneous		2,264	5	36,548	23			843		2
Total	42	4,209	980	37,733		23		849		2

No. 14.—*Post-mortem inspections in Sisiman abattoir during fiscal year ending June 30, 1912.*

Kinds of animals.	Number of inspections.	Number passed.	Condemnations, causes.	Carcasses.	Parts.
Cattle	8, 104	7, 937	Abscesses		137
Sheep	36	36	Bruises	1	17
			Carcinoma	1	
			Congestion		2, 894
			Deficient bleeding	1	
			Emaciation		
			Foetus		42
			Found dead	115	
			Icterus		36
			Inflammation		268
			Melanatic tumor		1
			Ossophagostoma larvæ		391
			Pleuropneumonia, contagious	1	317
			Septicemia	3	
			Tuberculosis	44	1, 766
			Tumor		4
			Ulceration		1
			Miscellaneous		19
Total	8, 140	7, 973		167	5, 893

No. 15.—*Total affected with various diseases year ending June 30, 1912.*

Provinces.	Rinderpest. ^a	Foot-and-mouth disease.	Hemorrhagic septicemia.	Hog cholera.	Lymphangitis.	Glanders.	Surra.	Other diseases.
Albay								
Agusan								
Ambos Camarines								
Antique								
Bataan	644							
Batanes								
Batangas	120		2					7
Benguet								
Bohol	54							20
Bulacan	279	15				13		4
Cagayan	226			10		3	40	7
Capiz		9					3	
Cavite	11							11
Cebu	150		14			3	44	20
Ilocos Norte								
Ilocos Sur								
Iloilo	77	97						2
Isabela	236					9		4
Laguna	472							
La Union	312							
Leyte	37				3		37	5
Manila		218			2	28	28	
Mindoro								
Misamis						1		3
Moro								
Mountain	32				1	7		2
Nueva Ecija	208							
Nueva Viscaya	14					3	39	
Occidental Negros		822					17	
Oriental Negros	74							
Palawan								
Pampanga	464							2
Pangasinan	418		14					32
Rizal	122		13			16		55
Samar								
Sorsogon								
Subprovince of Marinduque								
Surigao	17							7
Tarlac	175		1			5	4	
Tayabas								
Zambales	377					5	8	269
Total	4, 519	1, 161	44	10	6	93	220	450

^a Rinderpest figures include cases held over from previous fiscal year and therefore exceed somewhat the figures given in the body of the report. Figures for rinderpest in Pandacan quarantine station are not included.

No. 16.—Deaths from various causes, by provinces, year ending June 30, 1912.^a

Provinces.	Deaths from rinderpest.		Killed for—						Deaths from other diseases.			
	Carabaos.	Cattle.	Carabaos.	Cattle.	Carabaos.	Cattle.	Horses.	Glanders, horses.	Carabaos.	Cattle.	Horses.	Hogs.
Bataan	449		1						2			
Batangas	14	69							13	11	2	
Bohol	33	3							15	2		
Bulacan	175	28							77	1	10	
Capiz	67	191							16	28		8
Cavite	3						1	3	2			
Cebu	134	2							10	9	13	
Ilocos Sur									353	43	118	
Iloilo	41	4							6	4	1	
Isabela	167	6						7	7	1	3	
Laguna	38	13							8		1	
La Union	137	5							26	3		
Leyte	37								7	1	46	
Manila							2	25	1	4	5	
Mountain	16	4						1	2		8	
Nueva Ecija	153							2	2		3	
Nueva Vizcaya	1						10	2	3		3	
Occidental Negros					1		2		21	2	1	
Oriental Negros	35	29	11	1					2			
Pampanga	324	2							60		4	
Pangasinan	196	48							53		1	
Rizal	99	15						3	203	4	16	
Surigao	3		13	1					5		2	
Tarlac	95	10							5		6	
Zambales	113	7					1	4	207	25	39	
Total	2,327	439	25	2	1		18	46	1,106	138	279	8

^a Deaths of imported animals in Pandacan quarantine station not included.

No. 17.—Results of simultaneous inoculation.

PANDACAN QUARANTINE STATION.

CATTLE.

Lot.	Number received.	Died before injection.	Slaughtered.	Died after first injection.	Died after second injection.	Released.	Percentage of loss.
1	244	1	4	1	1	237	0.08
2	329	1	3	0	0	325	0
3	416	2	85	5	186	138	58
4	101	1	0	13	14	73	26
5	121	5	0	33	0	83	28

CARABAO.

1	26	0	0	2	1	23	26
2	95	22	0	50	(a)	^b 23	28

^a No second injection of virulent blood.

^b Waiting to be dipped for scabies.

No. 17.—*Results of simultaneous inoculation—Continued.*

ILOILO QUARANTINE STATION.

CARABAO.

Received.	Dead before inoculation.	Dead after first inoculation.	Dead after second inoculation.	Released.	Percentage dead. ^a
268	0	45	6	217	19
396	138	5	0	253	2
219	2	29	0	188	13
102	48	0	0	54	0
220	2	38	17	163	25
1,205	190	97	23	875	^b 13

^a Average percentage of deaths deducting "Died before inoculation."^b Deaths before inoculation, 15 per cent.

Total receipts, 1,205. Total deaths before inoculation, 310. Dead before and after inoculation, 25 per cent.

No. 18.—*Cost of publishing and delivering the Philippine Agricultural Review, fiscal year 1911-12.*

Date.	Number of copies.		Printing.		Wrappers.	Postage.
	English.	Spanish.	English.	Spanish.		
July	3,300	3,750	P720.95	P786.60	P54.40	P52.88
August	3,600	3,750	1,200.95	1,149.55	388.66	55.88
September	3,300	3,750	1,134.66	1,070.20		52.87
October	3,300	3,750	967.48	913.85		52.87
November	3,300	3,750	789.64	775.10		52.88
December	3,300	3,750	709.45	751.95		52.87
January	3,300	3,750	907.23	896.80		98.22
February	3,300	3,750	839.27	872.09	187.60	39.40
March	3,300	3,750	729.42	735.85		36.60
April	3,300	3,750	1,156.20	1,088.95		7.76
May	3,600	4,000	809.85	807.70		45.64
June	3,300	3,750	871.05	881.40		63.06

	Copies.	Cost.
Index to Vol. II (English)	1,000	P271.86
Index to Vol. III (English)	1,000	255.28
Index to Vol. IV (English)	1,000	290.33
Title page for Vol. I (English)	200	
Title page for Vol. II (English)	200	
Title page for Vol. III (English)	200	10.50
Title page for Vol. IV (English)	200	

No. 19.—*Complete mailing list of the Philippine Agricultural Review, fiscal year 1911-12.*

Manila:	
English edition	391
Spanish edition	133
United States:	
English edition	320
Spanish edition	5
Foreign:	
English edition	316
Spanish edition	46
Provincial:	
English edition	1,655
Spanish edition	3,228
Total for Manila, United States, and foreign.....	1,211
Total for provinces	4,883
Grand total	6,094
Total for English only.....	2,682
Total for Spanish only.....	3,412

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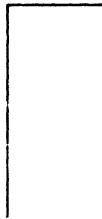
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